AN ABSTRACT OF THE THESIS OF

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The purpose of this study was to understand how adult learners in an online teacher licensure program selected and used learning strategies, transformed existing strategies or developed new strategies. Also examined was whether the environment itself facilitated or impeded usage of transformed strategies, or development of new strategies. Participants in the study performed a critical self-assessment each of five terms of the study following their completion of the tasks for the program, which included a discussion of the problems of learning and strategy usage. At the end of the fifth term, students answered nine questions relating to their overall experience, and answered six follow-up questions based upon answers to the original questions. The major findings were that students tended to rely upon their existing strategies with minimal transformation. Students also approached their learning strategies either meta-cognitively or tactically which affected their performance. Further research seems appropriate to examine ways in which program and web sites can be designed, such that in their usage they become strategy facilitative and reinforcing for adult learners.

A Study of Adult Student Learning Strategies For a Web Based Teacher Licensure Program

by

Sylvia Mary Twomey

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

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Sylvia Mary Twomey, Author

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DEDICATION

This thesis is dedicated in loving memory to my grandmother,

Mattie Lee Marshall

for whom education was the prime achievement

A Study of Adult Student Learning Strategies
for a Web-Based Teacher Licensure Program

SCOPE OF STUDY

Introduction

The major question of this study asks whether perspectives on human cognition are affected by the orientation of the learner and the perceiver. All disciplines are examining the same thing, how human learners learn and the tools they use, either cognitively or behaviorally to facilitate this learning. Do the theorists' perspectives bear resemblance to each other, and do the learner's perspectives bear resemblance to other strategies they use, to their perspectives about themselves, or to the program and its content.

It is anticipated that from this research will come some insight into ways in that web-based instruction can be designed to accommodate major factors bearing on a web-based student's selection and/or usage of learning strategies.

Historically, there have been drastic changes in knowledge and beliefs about human experience of the natural world, and the way the human body functions. If theories of cognition and learning have changed as a result, do adult students, specifically those in a web-based instructional environment, require new learning strategies. Or is it a matter of re-interpreting their usage of strategies they already have in light of the newly defined theories of learning, do theories relate to strategies that relate to learners that relate back to theories about learning. Is the

environment within that learners are learning, necessary or coincidental to the selection and usage of strategies. Might there be effective strategies that can be taught to learners in this new environment that would be used by them and maintained. Can potential learning strategies be incorporated as part of web page content such that usage of the information from the page becomes a reinforcement of the strategy.

Because of the inherent nature of web-based instruction (at a distance, asynchronous, and electronically delivered), one of the closer issues for adult learners is the relevance of existing strategies acquired in a traditional classroom environment when applied to a web-based environment. One of the long-range issues is the relevance of historical and emerging theoretical perspectives on cognitive processing and their relevance to web-based instruction.

Generally, the teaching of learning strategies is an integral part of a child's K-12 educational experience and much thought has been given to how these should be taught, what types of strategies are most effective, given the subject matter, and how the strategies can be reinforced. Learning strategies taught to children include cumulative rehearsal-fast finish, labeling, and elaboration strategies to name a few (Flavell, 1976). However, many of these learned strategies have fallen into disuse by the time a child reaches college-age. Later there is generally no regularized effort on the part of the educational system to periodically reinforce learning strategies for adults (Schunk, 1996).

Rather extensive studies focusing on this problem as a meta-cognitive issue over the past 20 years assumed the perspective that students were not using and maintaining their strategies because they had not been properly informed regarding the overall utility of the strategy. Nor had they been adequately informed regarding the conditions under that the learning strategies would most likely work (Brown, et al, 1983). What was discovered from this research is that learning strategies tend to be tied to the context in that they are acquired (Brown, et al., 1983; Duncker, 1945). Breaking this tie, and facilitating subsequent transference or transformation of an existing strategy to a new context is one of the goals of new theories of cognition and learning. Transformation of strategies is more difficult when the learner enters a radically different context, that Web-based learning tends to be for students coming from traditional classroom environments, especially for adult students who have spent years in the traditional system and have been successful at it (Mezirow, 1994). This would identify the majority of older than average adult students who attend college and university classes.

In adult education, the teaching of learning strategies is usually reserved for remedial classes, special circumstances, or workforce training. The average college student, no matter what their age, is expected to use learning strategies they already know. Or they are expected to develop learning strategies appropriate to the subject matter they are studying from interaction with the course content. Acquisition of new strategies or transformation of existing strategies is expected to be learner controlled and directed (Brown, et al. 1983; MacKeracher, 1996; Mezirow, 1994).

A further issue relative to learning strategies has to do with the appropriateness of the learning strategy to the age of the learner and the task for that it is used (Best, et al., 1992). Studies on school-age children have shown that strategies appropriate for children under the age of eight are not appropriate for children over eight or adults (Shimron, 1975), and vice versa. Research regarding the type of learning strategies that are appropriate for adults has been intermittent and incomplete. Adult learners working in web-based programs manifest some age-related attributes that younger adult learners do not (Billington, 1988; Lieb, 1996; Zemke & Zemke, 1984).

Learning Strategy Usage and Maintenance

When an age-appropriate learning strategy was apparently acquired, there is still a breakdown in maintenance of the strategy and transference to similar learning situations (Barer-Stein & Draper, 1997). Even when adults know a particular strategy may be successful in a certain learning situation, they do not use it routinely (Brown, et al., 1983; Duncker, 1945). Nor are the more complex learning strategies commonly used among university students, who may have the most need of such strategies. (Pressley & McCormick, 1995). The lack of strategy maintenance and usage is compounded when one attempts the transference of a strategy to a radically different environment, web-based learning.

This study attempts to suggest a connection between student learning strategies, their cognitive processes, and the potential for development of a web-

based learning environment, that will at least support student learning, or that will at best facilitate student maintenance and transformation of learning strategies and development of new strategies appropriate to students learning needs (Mezirow, 1994). However, there is an inherent issue regarding logical disconnect between teaching and learning, as well as the issue of a physical disconnect when the teaching and learning is taking place over the Web.

Logical Disconnect Between Teaching and Learning

Even for an educator in a traditional classroom environment, there is a logical disconnect between teaching and learning. Since a teacher cannot see the how and when of learning (brain-based processing), the connection cannot be made with any certainty that the result follows from the cause of teaching. Teachers can examine the external manifestations that are believed to be the result of teaching, student's behavior, products of their learning, or what they say about what they know. However, it is impossible to prove any necessary connection (Hume, 1955). The best that we can hope for is a consistency in result or an increase in knowledge over time that we may use as a basis for reinforcement of those student learning strategies that we believe were instrumental in achieving the result (Pressley & McCormick, 1995).

The epistemological question becomes, do learners discover knowledge that exists out there in reality or do they construct it for themselves through a process of

language, thought, and social interaction (Cross, 1999). And, if students are learning on the Web, how is this accomplished?

Physical Disconnect for Students on the Web

Compounding the problem concerning acquisition or transference of learning strategies for adult students in a Web-based environment is the fact that student and teacher are literally not in the same physical place. The issue of social presence can become critical for the student who may be attempting to enhance their learning experience with a sense of reality that the teacher and the other students are actually real people with whom they may communicate and in the process develop a relationship (Gunawardena & Zittle, 1997).

Potential recognition of effective adult student learning strategies in a traditional classroom can come from teacher and student face-to-face interaction, and teacher observation of student behaviors. For teachers of web-based instruction, none of this may be available. All that instructors in a totally web-based, distance delivered environment see are the products of learning (text, graphic images, etc.), not the processes. And those products, presently, are primarily expressed in text. Student in this same type of environment do not see each other. They see typed text. Any clues that teachers and students might get from personal interaction or observation are unavailable. This has an impact on student learning and their building a sense of community in a web-based environment.

Instructors in a totally web-based environment can only gain knowledge of adult students' learning strategies from students' words. In the totally web-based environment, this means the written word. Using only students' words about their learning strategies is necessarily limited. It presumes self-awareness on the part of the student regarding their own learning needs, processes, strategies, and their ability to express themselves in written form. For non-native speakers, learning-disabled, or visually impaired, the problem is compounded.

Also important to conclusions that have been made about teaching and learning in a web-based environment are beliefs about the manner in that cognitive processing occurs, and the relationship between learning strategies and cognitive processes. Let's examine the relationship of learning strategies to cognition.

Relationship of Learning Strategies to Cognition

Basic human cognition has not changed since Homo Sapiens replaced the Neanderthals (Morell,1995, Pfeiffer, 1969). What have changed are the ranges of human experience, and our method of passing prior knowledge down to our progeny. What has also changed are our perspectives on cognition and learning, our ways of measuring it, testing it, and our ways of analyzing and interpreting the results of those tests.

Learning strategies are the pre-processing for cognition. They are a human's ways of organizing, and categorizing experiences and then providing the results, or seeking more information, or preparing 'information' in some way as input to

cognitive processes. The output of human cognitive processing is revised knowledge,(schema) represented by thoughts, words, and actions resulting from a synthesis of the new information with what has been experienced, or learned before (Bruner, 1956; Schunk, 1996).

However, the processing piece, the cognitive process itself, is still a mystery concerning ways in that the brain actually coordinates all of the functions in the process called thinking. There is a disconnect in our knowledge and understanding about the relationship of the brain's physical processes and its mental processes. This problem has historically been referred to as the mind-body problem, more currently referred to as the mind-brain or binding problem (Kandel, 1995).

Research in neural networks is proving that there are several hierarchical pathways or systems processing in parallel and interacting within the brain. (Crick, 1994; Gazzaniga, 1988, 1992; Minsky, 1986; Penrose, 1989; Restak, 1984). However, an explanation of the manner in which the brain constructs our perceptions of the world from sensory images, how these images are stored, retrieved, and brought into consciousness for initial as well as additional processing based upon subsequent experience is still very much in a state of evolution.

When we begin to examine definitions and perspectives about cognition and learning from various academic disciplines, we find that not all disciplines include all the elements that appear necessary to cognition and learning within their studies. Most of the research done in the various disciplines relates specifically to the elements that the discipline considers important, leaving out some factors that are

considered to have an impact on learning and cognition within other disciplines. For example, learning strategies are considered separate from cognitive processing in some disciplines, an integral part of cognitive processing, antecedent to cognitive processing (Simon, 1969, 1981, 1996), or an adjunct of cognitive processing.

This may seem like a small distinction but it makes a big difference when one attempts to apply the results of research to teaching and learning, particularly in a web-based environment. This leads us into an interdisciplinary conflict of assumptions, definitions, interpretations, and beliefs that are at once historical as well as emerging. Let's examine some of the varying definitions and conflicting assumptions, that are embedded in these definitions by the various researchers, and theoreticians who formulated them.

Definitions of Learning and Cognition

In the course of the present study, literature and definitions from four different disciplines will be referenced: psychology-education, and information processing. Since most definitions utilized in education have been formulated by psychologists, psychology and education will be referred to together, , psychology-education. A psychological-educational definition of learning strategies defines them as cognitive plans oriented toward successful task performance (Schunk, 1996). A more formal and elaborate definition (Pressley, & McCormick, 1995) includes what we might call contingent sub-strategies, as well as meta-cognitive processes:

> "Strategies are composed of cognitive operations over and above the processes that are a natural consequence of carrying out [a] task, ranging from one such operation to a sequence of interdependent operations. Strategies achieve cognitive purposes (e.g. memorizing) and are potentially conscious and controllable activities (Pressley & McCormick, 1995, p.24)".

This definition makes a number of assumptions about learning strategies and cognitive operations with wording that makes it appear as though cognitive operations are subordinate to learning strategies rather than the reverse, or even that the two are equal in some way.

Psychologists' take varying perspectives, experimental and/or cognitive, and make underlying assumptions, that result from the discipline, objective, and practice from that the studies have emanated. Many researchers whose theories are considered Educational Theories are actually Psychologists. David Ausubel, a cognitive psychologist who focuses on cognitive operations as dependent upon language acquisition, states that,

> "Cognition involves concept formation and the nature of human understanding of structure and syntax in language. New information is highly dependent on the relevant ideas already in [the] cognitive structure, and meaningful learning occurs through an interaction of new information with relevant existing ideas, the result of that is that the new material is assimilated with the old and new meanings form, resulting in more highly differentiated cognitive structures (Ausubel, et al., 1978, p.92)".

It appears that Ausubel is assuming that cognitive operations cannot take place until one has acquired language in that case he is discounting pre-verbal learning as well as visual and auditory learning even after the acquisition of language. Another issue, that Ausubel does not address, is the manner in that the

first cognitive structure was acquired if meaningful learning occurs through interaction of new information with relevant existing ideas. Is the presumption here that any learning, that occurs pre-linguistically, is not relevant. If so, how does it graduate from irrelevant to relevant once a person has acquired language.

Accepting for the moment Ausubel's construct of the manner in that learning is acquired, once one is verbal, how does one acquire relevant knowledge about experiences or subjects, that one has not encountered before? This is an extremely relevant question for students and teachers in a web-based environment.

Although Ausubel was formulating his theory throughout the sixties, J.S. Bruner, was also working throughout the 1960's. Bruner's work is considerably different from that of Ausubel although both are described a cognitive learning theorists. Bruner defines cognitive operations from the perspective of information processing even though he is a cognitive psychologist:

> "Development of human intellectual functioning shaped by the systems for processing information through which humans construct models of their world using action, imagery, and language, also concerning itself with integration of information organized into higher-order series of ensembles making possible use of larger units of information for solutions to particular problems (Bruner, 1973, p.22)".

J.S.Bruner was profoundly interested in the research being done in Artificial Intelligence by what he called the Harvard-MIT Group. Bruner stated that he regretted not getting involved earlier. But at the time, Bruner considered the work he was doing to be a more concrete way of formulating his ideas (Bruner, 1983). However, Bruner's definition of cognitive processes shows considerable theoretical

connection to the theories of human information processing that resulted from those studies.

When we examine beliefs about cognition from someone who has been doing research in artificial intelligence and neural networks for the past forty years, we find a definition that not only makes information processing a focus, but the primary feature. Herbrt Simon's definition of cognition states that:

> "The human cognitive system is comprised of variants that underlie change, the basic parameters of memory, and the general search and control processes, among that are processes that bring about the adaptation of long-term memory. Therefore, understanding systems capable of understanding problems in new task domains are learning systems. There is no single kind of change in the human cognitive system to that learning specifically applies for the multiplicity of forms of learning are reducible to a few fundamental functions corresponding to the main components of the cognitive system, acquiring information (stored data structures), and acquiring skills (stored procedures), human learning of most kinds can be explained within the framework of the symbol-processing system"(Simon, 1996, p.110).

Simon discusses at length (1981, 1996) the important difference between the real and the artificial. By 1996, in the edition of his book, Sciences of the Artificial , Simon gives a much clearer definition of what he calls 'artificial' and it seems apparent that he believes that theories of computer processing have been applied inappropriately to human intelligence processing. However, the framework of the symbol processing system that Simon refers to is a direct result of his and others' research in artificial intelligence that began with the Conference that he and Allan Newell were instrumental in calling together at Dartmouth in 1956 (Crevier, 1993).

The resulting information processing theories of cognitive operations and learning have become often too uncritically embedded in textbooks for education (Anderson, 1974,1983, 1985; Hart, 1992). The assumptions that accompany these theories and models derived from them have been inherently structuring many of our teaching practices and beliefs about the way students learn. As a result, many of these theories are also uncritically finding their way into our assumptions about the way students learn in a web-based environment. We need to re-think these assumptions and resulting theories and models.

Finally, I do not believe that we can discuss human cognition and learning without examining the physiology of the process. The last definition of cognition comes from a researcher in Neurobiology, Eric Kandel:

> "It is the conviction of neural scientists that a cellular approach is necessary to understanding how the brain works...it is essential to understand how events in individual cells lead to cognition. Toward this end the methods of cell biology need to be combined with techniques that relate the activities of interconnected populations of cells in animals and human beings during normal activities. This combination of methods--cell biology, systems neural science, brain imaging, cognitive psychology, behavioral neurology, and computer science--has given rise to a concerted approach called *cognitive neural science,* designed to understand the neural mechanisms that give rise to behavior. (Kandel, Schwartz, & Jessel, 1995, p.322)".

All of the above reinforce what I believe our examination of what has been the historical and operational difference in focus and discussion by researchers in the various disciplines relative to human cognition and learning since there have been distinct disciplines studying these subjects. Generally educators' research focuses on practical application and proofs that learning has taken place.

Psychologists focus on both behavior modifications on the one hand, and cognitive psychologists focus on cognition and learning. Information processing researchers are interested in processes, and in structure and memory as they relate to and support the overall process.

Physiologists are interested in physiological processes, recursive neural activities, and attendant changes. Most researchers in all of the above groups discuss the basic elements of learning, cognition, and memory, but do not address them in a manner useful for the professional educator to apply to learning in the classroom or on the web.

Re-statement of the Problem

Given the pitfalls of various types of research, the question becomes whether it is possible to work our way backward from a study of learning strategies through the myriad theories of cognition to the basic cognitive processes used for learning, and whether from there it is possible to identify and determine that learning strategies from an environment are most supportive of those cognitive processes. Having determined some idea of what types of elements are supportive of cognitive processing in a learning environment, can we then work our way forward again to answer the question, is it possible to develop supportive structures in a web-based environment .

Approach to Examination of the Problem

It is most likely obvious that the statement of the problem as posed above has a number of elements and examination of them constitutes a great task, that can continue to be examined in parts over time. The purpose of the immediate research is to focus on use of learning strategies by collecting information from those most directly involved, the students. Too often the examination of problems, that students may be having in various learning environments, comes from teachers' words. In most cases students are rarely asked directly what problems they are having. This study approaches its research using the words of the adult students working their way through a web-based teacher licensure program who describe their learning experiences in their own voice, and what they know or believe about the learning strategies they have used in completing the program.

Assumptions

In order to do the above research, a number of major assumptions had to be made by this researcher:

- that the information was available and obtainable.
- that it is possible to gain clues to a student's cognitive processes by examining their descriptions of the learning strategies they use to access, organize, and study course content (Flavell, 1976), and use to navigate the course delivery media in order to reach the course web-site, , the world-wide web.

- that students are, can be, or want to be self-aware enough, meta-cognitive enough, and objective enough to examine their own learning strategies, the source of their strategy development, and or transformation of those strategies over time in a specific learning situation, and can articulate their understanding of this process and the resulting strategies in a written form that they can communicate to another person, in this case the researcher.
- that a student learning on the web can separate and examine individually or together those strategies that are used for learning and reflecting on course content, and those strategies that are used for skill mastery of the technology (Carlson, 1997).
- that all of the students have some degree of positive motivation (Bee, 1998), because they are working in public schools in practicum or internships near their homes at the same time they are completing web-based classes, and that completion of the program that results in initial licensure to teach in Oregon public schools is a sufficient motivator.

The following review of literature will briefly trace historical theories of cognition and learning from Plato and Aristotle which seem relevant to emerging theories that relate to web-based instruction.

REVIEW OF LITERATURE

Historical Perspectives on Cognition & Learning

Historically, there have been drastic changes in knowledge and beliefs about human experience of the natural world, and the way the human body functions. As a result, these changes have also affected our understanding of human cognition and learning.

The first recorded theories of Learning can be traced to the Philosopher Plato (427-347 B.C.), a Mathematician and Astronomer, who was inspired by Pythagorean teaching (Watson, 1963). Plato believed that ideas exist in an absolute form, 'a priori', independent of any cause, and an individual learns about them through the application of reason and reflection. Even though Plato believed that knowledge of the real world is gained through the senses, he also believed that what our senses tells us about the real world only represent copies of the absolute idea. Plato believed that mind and matter (body) were separate and that our understanding of the absolute ideas is induced from our experience, and reflection upon the relationship between the copies and the absolute ideas (Eysenck & Kamin, 1981). For a thinker during Plato's period observation of natural events was coincidental to theories that resulted from reflection upon the nature of them.

Aristotle (384-322 B.C.) as a Biologist was more interested in particulars, particular species of animals and particular physical phenomena. Aristotle believed that there was no sharp distinction between mind and body (or matter) except for

the differentiation between what he called cognitive or thinking-problem solving, and hormic or feelings-emotions (Eysenck & Kamin, 1981). Aristotle attempted to define a latent structure underlying intelligence that he deduced from behavior. He made one of the first references to associative learning in his belief that the recall of an idea or object triggers the recall of other ideas or objects that are similar to it.

The separation between Plato's theories and Aristotle's ultimately led to a split in Philosophical beliefs with Plato's followers becoming Rationalists and Aristotle's followers becoming Associationists. Out of this split also came ideas about a number of elements inherent in cognitive processing, and from them developed theories of cognition and learning.

- Association & Organization of Ideas
- Transfer of Ideas & Knowledge
- Introspection and Reflection
- Relationship of Learning & Behavior to Environment

The most important and pervasive of these is the 'Association and Organization of Ideas' for it underlies the theories of cognition and learning that followed.

> "Associationism is more a principle than a school of psychology. The principle of association derives from epistemological questions within philosophy. The epistemological question, 'How do we know?' is answered by empiricist philosophers, 'Through the senses'. Immediately the next question arises: 'Then where do the complex ideas come from, since they are not directly sensed?' The answer to this second question gives the first principle of association: 'Complex ideas come from the association of simpler ones'. Since Associationism thus has its roots in philosophy, its history extends back into antiquity...and its influence

> extends into the present...in one form or another associationistic ideas have been taken over by all ...schools (Marx & Hillix, 1973, p.89)."

The association of mind to body has also continued to plague research and debates about human cognition and learning. Rene' Descartes (1596-1650) called existence into question with his famous "I think, therefore I am" argument. Descartes was considered a dualist because he claimed that the world consists of two basic substances, matter and spirit (Marx & Hillix, 1973). Over the intervening centuries psychologists and philosophers have felt it important to take a position on the mind-body problem, because its dichotomy has become embedded in our theories about cognition and learning. Its debate continues among philosophers and psychologists, and has also become embedded in information processing theory. It is currently providing a paradox to physiologists and neurobiologists, where it is more commonly called the binding problem (Kandel, 1995).

Aristotle's ideas regarding associative learning were addressed in the 17th and 18th century by a group of philosophers called the British empiricists most notably John Locke (1632-1704), and David Hume (1711-1776).

John Locke's major concern was the validity of knowledge (Locke, 1690). He believed that all knowledge comes from experience either through the senses or through reflection on sensory information, and that there are no innate ideas. Rather the mind is a 'tabula rasa' on which experience writes. Locke believed that ideas are combined in experience according to principles like those of similarity and contiguity. Locke also formulated a theory of primary and secondary qualities of bodies that were the basis of sensory ideas. Primary qualities inhere in objects and

form an avenue between the mind and the external world. They are properties such as solidity, figure, motion, and number. Secondary qualities do not inhere in objects but are functions of the mind and are ideas such as colors, sounds, and tastes (Boring, 1957).

It is David Hume (1711-1776) whose work had a more lasting impact upon philosophy and thinking in general for Hume is considered to be the father of inductive reasoning. Hume differentiated between impression and ideas. Ideas are identified as the experience we have in the absence of its object. He identified an impression as the sensation or perception. In essence, Hume took Locke's interpretation of ideas that included sensation, and removed sensation to a separate construct that he called impression (feeling). This distinction has tended to escape criticism because of the readiness with which everyone perceives the difference between feeling and thinking. Ideas thus separated can take on the character of association, for a simple idea may be separated by imagination and may be united again in various forms, not guided by a universal principle rendering it uniform in all times and places (Boring, 1957). This is an enormous step in freeing individual ideas for free and varying association and basically paves the way for Minsky's theory of frames (Minsky, 1986).

Hume described his thought on the Association of Ideas as follows:

> "It is evident that there is a principle of connection between the different thoughts or ideas of the mind, and that in their appearance to the memory or imagination they introduce each other with a certain degree of method and regularity" (Hume, 1955, p.31).

Later Hume suggests that there are three principles of connection, resemblance, contiguity in time or place, and cause and effect. To make an effective cause and effect argument, Hume believed that three conditions must be satisfied:

- contiguity - cause and effect must be contiguous in time and space with no causal action at a distance, and no lapse or interval of time, and having spatial and temporal immediacy.
- cause must always occur prior to effect.
- there must be a necessary connection between cause and effect. (Watson, 1963)

Hume applied empiricist thinking to the notion of causality and maintained that all we really know is that some events are invariably contiguous in space and time and our notion of causality is based on this observation (Marx & Hillix, 1973). He argued that a necessary connection between cause and effect were incapable of proof using his famous argument that if the sun came up today, it doesn't necessarily follow that it will come up tomorrow. Ultimately he subsumed cause and effect into contiguity leaving only two laws of association, resemblance and contiguity (Boring, 1950).

Not only did Hume's arguments regarding the laws of association have import for present-day learning theory, but also his arguments concerning the uniting and re-uniting of ideas independent of any universal principle leads to later theories about schema and the construction and re-construction of knowledge. "Hume's

conditions of causation, resemblance, and contiguity are relations by which we associate ideas. As such, these relations have no existential significance for they represent activity of the imagination and not ideas reducible in any way to impressions" (Marx & Hillix, 1973, p.93). This view is attributed to aiding psychology in freeing itself from philosophy, and Hume is considered one of the heroes of this effort (Marx & Hillix, 1973).

In the last half of the 19th century, there were several theoretical pathways developing in psychology at nearly the same time that were called structuralism, behaviorism, functionalism, and connectionism. In examining the works of those who gave themselves these identifiers, it is difficult to see very much difference in the ways that they applied the concept of the association of ideas. Also, it seems apparent that many of theories presaged the adoption of the concept of the association of ideas within cognitive psychology and social learning theory.

As a structuralist, Edward B. Tichener (1867-1927), believed that the mind is made up of an association of ideas and that the researcher, in order to understand how the mind functions would need to break down the associations into smaller sub-units or single ideas. In order to accomplish this, Titchener used a technique that he called introspection, a type of self-reflection.

As a behaviorist John B. Watson (1878-1958) rejected the technique of instrospection, stating that psychology should be focused on observable scientific phenomena which was behavior. The idea of introspection or reflection was not

considered a worthy pursuit for an experimental psychologist because its results could not be adequately proven. (Watson, 1963).

As a functionalist William James (1867-1949) focused on thinking as a process of developing ideas from an organism's behavior and consciousness which is in adaptation to its environment, and that one's stream of thought changes as experience changes (Schunk, 1996). This belief is attributed to the theories of Charles Darwin that the development of mental processes are separate from one's environment. Functionalists were also concerned with dependency relationships between antecedents and consequents, trying to determine what humans do and why (Marx & Hillix, 1973).

John Dewey (1842-1910) argued that psychological processes cannot be broken into discrete parts and that consciousness must be viewed holistically (Schunk, 1996). Interestingly enough, Dewey also argued that the results of psychological experiments should be useful in daily life and were therefore relevant to education. If Dewey believed that learning can only be viewed holistically and not also as discrete elements making up the whole, one wonders how he believed that incremental learning occurred.

Behaviorist theory suggested that for transfer of knowledge to occur, common elements need to exist between the situation where the behavior was learned and the situation to where the behavior is being applied, a belief that appears again in social cognitive theory.

As a connectionist Edward L.Thorndike (1874-1949) developed a theory of learning that involves the forming of associations or connections between sensory experience and neural responses that are expressed as behavior. He called these connections or associations laws; law of readiness relating to the satisfaction or annoyance of the unit's readiness to conduct; law of associative shifting relating to the transfer of knowledge or use of knowledge to a new setting; and law of exercise relating to the use and disuse such that neuronal pathways that are unaccessed shrink in size and are replaced by more efficient pathways (Schunk, 1996; Thorndike, 1914).

However, after extensive application of his theories to human learning, Thorndike decided that the role of punishment was not comparable to the positive result of reward, deciding that punishment causes the subject to try something else rather than dissociate the response from the initial action. (Marx & Hillix, 1973).

Thorndike believed that learning occurs gradually as successful responses are established and unsucessful ones abandoned thus making education incremental. Humans can go on to more complex types of learning that include developing ideas about things (connecting) and analysing and reasoning. Thorndike felt that an educated adult possesses millions of stimulus-response connections (Thorndike, 1914).

This idea of inter-connected groupings of ideas and responses was to re-surface and be invigorated by the research done in artificial intelligence in the 1960's; i.e. Simon and Newell's chunking , Minsky's frames , etc.

Behaviorists' approach to cognition and learning overshadows most research done between the mid-nineteenth and mid-twentieth centuries. This is mainly due to four researchers, Ivan Pavlov (1849-1936), John B.Watson (1878-1958), Edward Tolman (1886-1959), and B.F.Skinner (1904-1990).

Although Pavlov was a physiologist and focused his research mainly on experiments with animals, his research influenced both psychology and education. Pavlov noticed that his research animals began to secrete digestive juices when they anticipated food. At the time he began his work bodily functions were considered psychical impressions of the mind rather than measurable body functions. Through the course of his study he changaed from calling his research a study of 'psychical secretions' to calling them 'conditioned reflexes' (Boring, 1957). Pavlov's work provided the foundation for stimulus-response theory and was carried forward most notably in the United States by B.F. Skinner.

John B. Watson (1878-1958) vehemently opposed Thorndike's idea of introspection which represented consicousness and in the process moved objective psychology toward behaviorism (Boring, 1957). Behaviorism came to play an important role not only in psychology but also in general cultural affairs, where its influence rivaled that of the European import, psychoanalysis (Marx & Hillix, 1973).

Edward C.Tolman (1886-1959) reacted against traditional behaviorism because he felt that conditioning theories did not explain learning. He believed that learning was more than reinforcing responses. From his research, Tolman

developed a psychological theory called 'purposive behaviorism' within which he defined purpose objectively (Schunk, 1996). Tolman insisted that the data of consciousness are not public, and thus not available to science (Boring, 1957).

Tolman identified six types of learning one of which was field expectancy. This concept relied on the association humans make from a stimulus eliciting a certain response to a certain result. Tolman described it as someone wanting to climb on a roof, seeing a ladder, and making a connection. Rather than calling this cause and effect, Tolman referred to it as cognitive expectancy which are expectancies from one's experience to certain environmental conditions. Tolman believed that Humans use these expectancies to attain certain goals that he referred to as cognitive mapping (Schunk, 1996). In reflecting on Tolman's concept of placing the human response between stimulus and result, it almost seems as though he's introducing a certain necessity of result if one gives the appropriate response to the stimulus. If one agrees with David Hume, that a certain result does not necessarily follow from a certain cause, what Tolman has constructed is a paradox of result and purpose.

B.F.Skinner (1904-1990) is considered to have followed Watson's lead in the direction behaviorism was taking, and became a proponent of what was called radical behaviorism which emphasized behavior as the basic subject matter of psychology. To this point research in psychology followed the premise there was an association between response and its environment and that response could be learned. Skinner believed in functional relationships between environment and

behavior, as compared to Tolman who believed in purpose and Guthrie who believed in association. For Skinner, functional relationships could be understood in terms of environmental cues and results . He felt that theories of learning get in the way of learning about changes in behavior and he set out to discover laws that govern learning. (Driscoll, 1994).

Skinner examined two types of behavior, respondent and operant. Respondent behavior is involuntary in reaction to a stimulus, and operant behavior is emitted by interaction with environment. In this sense he included both humans and animals in operant behavior, and believed that in order to understand behavior, we must examine the environment surrounding the behavior that contains reinforcers within it (Driscoll, 1994). This theory seems to go back to Thorndike's law of effect , which states that when a connection is made between a situation and a response, and is accompanied by a satisfying state of affairs, the connection is strengthened. What appears to be a disconnection here is that responses, unless they are physiological reflexes to extreme environmental conditions (a hot iron), have cognitive aspects to them. This suggests to me that the 'response' in Skinner's theory is neither necessary nor totally under the control of the stimulus, or the force inflicting the stimulus.

However, the extent of Skinner's belief that behavior in humans could be controlled is quite considerable. He states that,

> "If we want to know why men behave as they do.. [then] any condition or event which can be shown to have an effect upon behavior must be taken into account. By discovering and analyzing

> these causes we can predict behavior, to the extent that we can manipulate them, we can control behavior" (Skinner, 1953, p.324).

Since Skinner did not consider what was happening consciously or cognitively, attributing only past events as relevant to the prediction of behavior, it is interesting that he believed that his theories could be adapted to educational purposes, for in his Skinner Box rats had no other distractions or stimuli so they learned rapidly. Skinner believed that humans were neutral and passive and that all behavior could be described in mechanistic terms (Bigge & Shermis, 1999).

Although I disagree with the rigidity of Skinner's work, I do agree that learning has definite behavioral components, but I am curious about what type, how many, and how strong they are. When I'm teaching students to use computers and its keyboard such that they can use it without looking at it, or thinking about it, or to appear to cognitively process it, I believe that I'm observing some behavioral conditioning that has occurred.

In 1924 Lev Vygotsky (1896-1934) reacting to Pavlov's theory which did not account for subjective experiences, challenged the dominant view that favored conditioned reflexes. Vygotsky focused instead on the relationship between conditioned reflexes and human consciousness and behavior (Driscoll, 1994). Behaviorists had basically erased the distinction between humans and animals, and Vygotsky argued that humans had an attribute that animals did not have, they are able to alter their environment for their own purposes. He called this attribute adaptive capacity, and stated that it distinguishes humans from animals. Vygotsky researched and wrote extensively on the social mediation of learning and the role of

the unconscious (Schunk, 1996). Vygotsky a devout Marxist utilized the basic thesis that "all fundamental human cognitive activities take shape in a matrix of social history and form the products of sociohistorical development" (Luria, 1976, p.48).

Vygotsky was opposed to the stratified approach taken by Jean Piaget to understanding the development of human intelligence, that he believed was much more complex than a theory based upon fixed time or developmental stages could explain. (Schunk, 1996), which garnered the resentment of Jean Piaget himself, who wrote this attack on the fundamental perspective of his theory (Piaget, 1962).

Vygotsky's interest focused on the manner in that humans acquire their higher mental processes that they continue to display throughout their lives. He considered the development of intelligence to be the internalization of socially rooted and historically developed activities which he believed is the distinguishing feature of human psychology. (Vygotsky, 1930). He realized that the tools change as cultures change, and the way to study the phenomena is to take a social-historical perspective. Vygotsky uses the concept of mediation to explain development in terms of emergence of forms of mediation, that social interaction's relationship to higher mental processes involves mediational mechanisms , that encompass the signs and tools of language, emphasizing meaning and the communicative nature of signs (Wertsch, 1985).

A.R. Luria, in describing his work with Vygotsky and the usage of the socio-historical approach, cites their sources back to Darwin and Spencer as a

scientist's way of attempting to trace the ways complex forms of mental activity develop and how elementary forms of biological adaptation to environmental conditions become more complex through the evolutionary process (Luria, 1976). However, Vygotsky took the evolution of sociocultural history as the emergence and change of psychological tools (Wertsch, 1985). Most notably, that the behavioral development of humans is already a development that is fundamentally governed not by the laws of biological evolution but by the laws of the historical development of society. The perfecting of 'means of labor' and 'means of behavior' in the form of language and other sign systems that serve as auxiliary tools in the process of mastering behavior take on the primary role (Vygotsky & Luria, 1930).

Vygotsky's theory regarding the Zone of Proximal Development, defined as the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers has led to a broadened understanding of the relationship between teacher and student and ways that the teacher facilitates, or scaffolds the student's learning. The incremental base is not necessarily developmental as in Piaget's theory. Teacher and learner work together on a task that the learner could not do independently because of its difficulty. Cognitive change occurs in the process as the cultural tools are shared, and it is this interaction that produces cognitive change as the learner internalizes the results. (Schunk, 1996).

There is also a socio-historical aspect to Vygotsky's Zone of Proximal Development in its belief that learning takes place over time, and as Vygotsky believed that cultures change, so in this theory he explains the change of the learners capacity for learning and their knowledge base. Also, embedded within Vygotsky's theory is the idea of association. In order for a student to learn incrementally, there has to be a memory of what was learned before, and an association in the learner's mind between what has been learned and what needs to be learned next, and in working with the more capable other , to formulate a process whereby the next step in learning can be reached (Vygotsky, 1930).

A number of applications have been affected by Vygotsky's theories, self-regulation, instructional scaffolding, participant modeling, reciprocal teaching, peer collaboration, and apprenticeship. (Schunk, 1996). Although large-scale translation of Vygotsky's work did not begin until the 1950's, his work had been known since the 30's. And, the affect of his work is most notable among researchers in what is called Social Cognitive Theory .

It seems to me that Vygotsky is what I would call, one of the 'crossover' theorists. In my terminology a 'crossover theorist' makes a statement about the discontinuities in a line of reasoning sufficient, compelling, and logical enough to open a pathway for others to follow and in the process, opens a new line of reasoning. Vygotsky appears to have made this pathway from Behavioral Psychology to Cognitive Psychology with theories of learning applicable to Education. However, even today the difference in the description of learning

between Behaviorism and Education seems to be a difference of degree rather than substance. In behavioral theory, learning is a change in the rate, frequency of occurrence, or form of behavior (responding), primarily as a function of environmental factors [and] involves the formation of association between stimuli and responses . In educational theory, learning is a change in the capacity for behavior (Schunk, 1996).

As it developed, social cognitive theory made assumptions about learning and behaviors that addressed the issues of reciprocal interactions among persons, behaviors, and environments: enactive and vicarious learning (the way learning occurs), and the distinction between learning and performance. (Schunk, 1996).

Albert Bandura developed what he called a triardic reciprocality . One of the important constructs of this theory was perceived self-efficacy or the belief by the individual that they are capable of organizing and implementing the actions necessary to achieve a certain result. This belief affects choice of task, persistence, expenditure of effort, and acquisition of skills. The reason Bandura titled is as triardic is because he saw it as a triangle with 'person' at one point, 'behavior' at a second point, and 'environment' at the third point, with the point of the triangle pointing down.

While Marx is considered to have turned Hegel on his head , using an upside down triangle with thesis, and antithesis on the top two points, and synthesis on the bottom point, it appears that Bandura has turned Vygotsky on his head . Where Vygotsky saw his triad as a triangle pointing up with 'sign' (language) on

one of the lower points, and 'tool' (object) on the other, and 'mediated activity' on the top point (Vygotsky, 1930), Bandura turned the triangle upside down and in representing his triardic theory shows 'person' at the top left point, 'behavior' at the top right point, and 'environment' and the bottom point (Pressley & McCormick, 1995).

One could say that the usage of triangles to express the two theories is coincidental, or that having three major points in a theory, it would make sense to use a triangle to express it. However, I believe that the images one uses to express one's ideas have meaning in themselves aside from what they are used to represent, that takes us into a different aspect of psychological theory, not covered here.

Bandura believed that learning is an information processing activity in that information about the structure of behavior and about environmental events is transformed into symbolic representations that serve as guides to action (Bandura, 1986). Expressed in terms of Social Cognitive theory, humans learn from their social environments in a number of ways:

- by observing models for behavior,
- getting corrective feedback,
- increasing self-efficacy,
- improving on performance,
- setting goals.

All of these make up what Bandura called reciprocal interactions between the learner and the learner's environment. A part of this is enactive learning where

one learns the 'consequences' of one's behavior which are not reinforcers or deterrents, but sources of information and motivation. Vicarious learning includes listening to live models, listening to symbolic or non-human models, and reading printed materials. Obviously the use of enactive learning and vicarious learning must be associated in the learner's mind with prior information or current learning that one is attempting to model . The association of the new concepts with the old is a necessary requisite for learning using Bandura's theory.

Bandura's theory also seems to provide a watershed between older more behaviorists theories of learning and what would become newer and very different theories of learning, for Bandura's social learning theory provides the best integrative summary of what modern learning theory has to contribute to the solution to practical problems (Bigge & Shermis, 1999). However, I think it should be noted here that Bandura's theory has been given different names by different writers explaining his theory, Social Cognitive Theory (Schunk, 1996), Observational Learning Theory (Guttman & Pressley, 1977), and Linear-Interactionist Social-Cognitive Learning Theory (Bigge & Shermis, 1999).

Bandura makes another departure from behavioral psychology by identifying 'different kinds of knowledge', and 'performance of previously learned behaviors' (Shunck, 1996). Bandura identifies them as three types, declarative knowledge that is in the form of facts, scripts, etc., procedural knowledge that are concepts, rules, etc., and conditional knowledge that is knowing when to use a type of knowledge and why. Bandura also discusses rule learning such as rules

governing language and concept attainment, and differentiates between cognitive skill learning and motor skill learning. This is an important distinction because research into brain-processing is suggesting that cognitive skills and motor skills are stored in separate parts of the brain.

An important feature of learning that had not been addressed directly by the behavioral psychologists, and is only addressed indirectly by early cognitive psychologists is the issue of memory. Although one basis of Skinner's research is operant conditioning, he yet refutes any interest in cognitive processing or consciousness . However, the knowledge of prior conditioning has to be 'stored' somewhere in the learner's brain in order for it to be initiated by the conditioned stimulus, or else the operant conditioning would have to begin afresh every time.

Even Bandura refers to memory indirectly, referring to it as retention , a sub-process requiring coding and transforming of model information for storage in memory, as well as cognitively organizing and rehearsing information. He believed that learners store information in two ways, as words or as images. And the type of storage is based upon the type of information that is being stored, language or text as words, and pictures or scenes as images.

The concept of schema was a major part of the research and the theory of Jerome Bruner, a developmental psychologist, whose theory is called theory of cognitive growth that describes the development of human intellectual functioning from infancy to such perfection as it may reach, shaped by a series of technological advances in the use of the mind. (Bruner, 1966). Within his theory Bruner describes

three ways to represent knowledge, enactive that involves motor responses in reaction to the environment, iconic that involves 'action-free' images, and symbolic that involves symbol systems for encoding knowledge, such as language and mathematics. Bruner believes that the last system is the last to develop and quickly becomes the preferred mode.

As a major part of application of his theory is the belief that the teacher needs to vary the instruction based upon the learner's developmental level, and that any subject can be taught at any age as long as it's appropriate to the learner's level. It does not mean, as has been interpreted, that anyone can be taught anything . Bruner's theory is often described as spiral that I also think is a misnomer. It is really iterative because he believes that the teachers should re-visit the same information with the learner, only at a higher or more complex level each time. Bruner uses this theory whether it's for the introduction of some new material, or continuing instruction in already learned material. When Bruner uses the term development level, he is not 'necessarily' referring to an age-related development level. He is referring to the learner's 'knowledge development' level.

Another concept in Bruner's theory is that of discovery learning which basically means that the learner obtains knowledge for themselves, learning inductively from basic examples in order to form rules and concepts. Bruner states it as discovery favoring the prepared mind, such that one is enabled to transform knowledge in such a way that one is able to go beyond to new insights (Bruner, 1977). It is probably this perspective of Bruner's that has caused him to now be

called a constructivist. Bruner also establishes benchmarks to his research, and discusses the nature of intellectual growth.

- growth is characterized by increasing independence of response from the immediate nature of the stimulus.
- growth depends upon internalizing events into a storage system that corresponds to the environment.
- intellectual growth involves an increasing capacity to say to oneself and others, by means of words or symbols, what one has done or what one will do.
- intellectual development depends upon a systematic and contingent interaction between a tutor and a learner.
- teaching is vastly facilitated by the medium of language, that ends by being not only the medium for exchange but the instrument that the learner can then use himself in bringing order into the environment.
- intellectual development is marked by increasing capacity to deal with several alternatives simultaneously, to tend to several sequences during the same period of time, and to allocate time and attention in a manner appropriate to these multiple demands. (Bruner, 1966)

Bruner centers his discussion on the above items around the mediating processes that a child utilizes in order to maintain its equilibrium in the face of changing environmental stimuli and educational instruction. It is these mediating processes that frees the child from control by the stimuli he encounters. Through

these interactions with the environment and the child's internalization of the results of his mediating processes, the child is able to grow and move beyond the information of a single occurrence. Bruner sees this as a transition from orderly behavior to intellectual behavior taking the child beyond empirical adaptation (Bruner, 1966).

Although Bruner identifies that a responsive and prepared tutor is the best person to guide the child in this process, he expresses some doubt about the way in that the family and the child's culture affect this process, while at the same time recognizing that the processes they represent need to be accounted for in the child's intellectual development. Bruner also feels that the nature of language and its functions must be an integral part of any theory of cognitive development. His last benchmark relates to the necessity for the intellectually growing and developing child to have an increased capacity to deal simultaneously with several alternatives for thought and behavior (Bruner, 1966). Bruner has used several concepts in his theory that have become increasingly important for intellectual growth, not only for children but also for adults.

Emerging Perspectives for Web-Based Instruction

Emerging perspectives for instruction on the web are coming from a combination of research in Psychology-Education, and Information Processing-Engineering. The differences in perspective among these groups is considerable, and quite understandably makes their disciplinary focus the lens through which the

research and its results are filtered. However, all research related to cognition and learning are relevant to web-based instruction, even if only as a way of understanding the process which may be necessary for transitioning from traditional theories to knew, yet unidentified theories.

At the present time there is a broad spectrum of literature discussing similar topic areas. For this reason when the literature became redundant and not productive of new information its line of research was limited to several of the major reviews. This was done for several reasons, first because the discussions were covering the same detailed subject areas that had already been covered maybe more effectively by another study, and second it seemed a more efficient use of time to go across the spectrum to research covering other areas from learning theory and learning styles to technological environments for learning to human visual and audio processing issues. Following is a discussion of the literature relevant to these topics.

Spiro (1993) suggests that the lack of success with many instructional systems is because they are too structured and simplified. This paper offers a constructivist theory of learning that also emphasizes real-world complexity and ill-structuredness of many knowledge domains. The researchers are particularly concerned with failure of learning and propose a theory of learning that addresses known patterns of learning failure. Their thesis is that forms of conceptual complexity and case-to-case irregularity in knowledge domains pose serious

problems for traditional theories of learning and instruction because of the following issues.

- failure of ability to transfer knowledge to new cases because of 'conceptual oversimplification' when attempting to de-construct complex ideas.
- need for a 'cognitive flexibility' that allows for construction of a 'knowledge ensemble' tailored to the specific problem.
- need for 'flexible learning environments' such that learners are able to use and develop 'cognitively flexible processing skills' and acquire content knowledge structures that can support flexible cognitive processing.
- use of the computer to create these 'flexibile learning environments' because it particularly suited for development of multi-dimensional and non-linear hypertext systems,
- use of computer power to project and re-organize varying perspectives of ill-structured knowledge domains,
- use of computer power to promote features of cognitive flexibility in ways that traditional media cannot because of their ability to produce non-linear learning environments.

Spiro calls a system that will perform the functions described above as 'Random Access Instruction' (Spiro, et al.,1993). One of the issues in working with ill-structured domains is that mastery of the conceptual complexity required for solving broad-based real-world problems make transfer to new situations difficult. Spiro's theory, that he calls 'Cognitive Flexibility Theory' can overcome these

obstacles by shifting from a constructivist orientation that emphasizes retrieval from memory of intact pre-existing knowledge to an alternative constructivist stand that stresses flexible re-assembly of pre-existing knowledge to adaptively fit the needs of a new situation. Such instruction can promote cognitive flexibility using theory-based hypertext systems that themselves posses characteristics of flexibility that mirror those desired for the learner .

Spiro's Cognitive Flexibility Theory, when systematically applied to his 'Random Access Instruction' can guide the design of non-linear computer learning environments, that he refers to as 'Cognitive Flexibility Hypertexts'. These environments would focus on learning objectives for advanced knowledge acquisition, and would only consider complex and ill-structured domains requiring special responses at the level of cognitive theory and related instructional interventions. Spiro describes ill-structured knowledge domains as those in that there is conceptual complexity and across-case irregularity. To solve such problems, the learner has to access multiple schemas, perspectives, and organizational principles, etc. (Spiro, et al.,1993).

Discussion of the lack of knowledge between beginning instruction and advanced instruction, particularly in ill-structured domains, leads Spiro to reflect upon the nature of learning failures based on the following features, conceptual misunderstanding,oversimplification (a tendency to 'reductive bias'), presumption that parts of complex entities studied in isolation retain their characteristics when re-integrated (additivity bias), continuously dimensioned attributes are bifurcated to

their poles (discreteness bias), realization that highly interdependent conceptual elements that have been studied in isolation are missing aspects of their interaction when recombined (compartmentalization bias). Strategies of this kind are no problem if the material is simple. Spiro believes that reduction is an inappropriate oversimplification if the material is complex.

'Cognitive flexibility theory' accommodates the fact that there are different points in cognitive processing where constructive mental processes occur. However, Spiro believes this does not occur in the traditional interpretation of 'constructivism', that relies upon 'schema' retrieved from memory, that are inadequate and inappropriate because of the very 'pre-packaged' nature of these schema, and that make them inflexible for application to complex ill-structured problems.

Cognitive Flexibility Theory is presented as a 'new constructivist' response, an integrated theory of learning, mental representation, and instruction. One of its basic strategies is re-visiting multiple positions of instructional content and re-visiting the same material at different times in re-arranged contexts for different purposes from different perspectives. This portion of Spiro's theory sounds like an elaboration of Bruner's theory with content covered at ever increasing levels of complexity in order to satisfy the needs of multiple knowledge representations. Spiro believes that one visiting of a complex case might miss important aspects that another visit from a different perspective might capture. The more complex and ill-structured, the more there is to be learned from each visit . He also uses the

metaphor of 'crisscrossing the landscape' using non-linear multi-dimensional traversals as the way to access various perspectives and degrees of complexity.

Spiro also sees constraints in the use of cognitive flexibility learning theory to design hypertext learning environments because learners may become lost in a labyrinth of ad hoc incidental connections. He believes that he can overcome this design flaw by making sure that the content when re-read instills in the learner an awareness of the 'shades' of meaning and the diversity of interpretation. At the same time the learner has the option to 're-construct' the instructional content to focus on those portions that they need to examine from a different perspective closely related in time. This sounds very much like Spiro is using Hume's law of contiguity to fix the connectedness in the mind of the learner of the cause and effect. It is a fascinating theory and offers a fresh look at the use of technology in an educational setting within that more insight inheres than most theories of application of technology to learning that I have read.

Tergan (1997) alsodiscusses the benefits of multiple representations of information as it applied to what are termed ill-structured domains. Ill-structured domains are described as problems that have no clear cut solutions, such as historical problems and social problems. The author's argument is that hypermedia can facilitate learning for students in problem solving in these areas because of its ability to provide multiple representations and multiple perspectives.(Tergan, 1997). Tergan's study is included here because he has made application of Spiro's theory.

All of Tergan's examples rely upon an instructor scaffolding students in their problem solving. The example that is used is a video of the film Citizen Kane. The description given by the author is that film can be re-sorted electronically and clips that reference specific themes can be spliced together using the computer. Students with the aid of their instructor could then study the themes by watching the sequence of related clips, and discussing them.

In referring to the failings of traditional methods of instruction, Tergan states that theories of learning and cognition are dominated by the communication metaphor and accompanying information processing approach , and information is presented primarily from the point of view of the instructor. The students must process the information presented in order to construct a mental representation that is expected to be congruent with that of the instructor, and the structure of the text and sequence of ideas that have been developed by the teacher or the textbook writer, direct them through this process.

The limitations of this form of instruction is that only one view of subject matter may not be appropriate or efficient for depiction of ill-structured domains . For the student to examine information of this type and proceed to construction of mental representations that are relevant, perspectives need to be examined under different conditions in order for knowledge transfer to take place. Use of multiple representations, such as those that hypermedia provides actively engages the learner more fully in the process of their own knowledge construction. It allows them to ask questions, interpret material, and compare different points of view.

The assumption of Tergan's article is that hypertext/hypermedia, that is able to represent matter content from different points of view, in different contexts, and using different symbol systems may facilitate learning. The supposition is that the combination of constructivist views and the flexibility of hypertext-based technology may overcome the limitations of the traditional text-based approach, that is very 'context dependent' and thus limiting to eventual transfer.

The fact that hypertext and hypermedia are non-linear representations of information are particularly interesting to those in information systems and engineering who realize the value of sub-dividing and independently interpreting material resulting in different perspectives. In education we might consider this too 'reductionist' or 'de-constructionist'. The information that the author in this article is referring to would reside in relational databases allowing for combination, and re-combination of text.

Graphics, video, and audio can be inserted, and re-inserted when desirable and appropriate, enhancing the potential perspectives from that the themes may be viewed. All of the various modules may be independently available using 'browsing' and 'searching'. Tergan believes that presenting hypertext/hypermedia in a different formt using different symbol systems, learning will be facilitated (Tergan, 1997). He continues to describe how usage of such technology allows for enlarging certain portions of the image for emphasis, or reducing it to de-emphasize it. In this way he suggests, that because of the flexibility of the media, the learner will be able to construct mental representations that are more readily adapted to

different situations, enhancing different aspects of subject matter, resulting in a better overall understanding, and enhancing cognitive flexibility and knowledge transfer (Tergan, 1997).

Tergan described the ability to cope with complex subject domains and to build mental representations containing elements of knowledge, representational formats, and symbols systems as a natural part of human cognition. I am assuming here that in using the term 'symbol systems' he is referring to language. However, in testing this theory, Tergan found that while multiple representations may enhance learning when instructional scaffolding is provided, it may depress learning with novice students because of the additional cognitive load in making sense of each of the representations, and their interelationship (Tergan, 1997).

Tergan also suggests that multiple representations might allow the learner to find a representation that is more applicable to the context and would allow specific elements to stand out against a shifting background .

The puzzling thing about Tergan's theory is that he appears to be describing objects even though he refers to them solely as mental representations. One is assuming from this that he may be thinking of mental images that are constructions of mind maps, mental images of relationships of subject elements within a larger grouping, or mental graphing or outlining. All of these are generally two-dimensional mental constructs, and are quite different from the one dimensional constructs that Tergan may be seeing in a textbook. However, mental representations of 3-dimensional 'objects' when presented by 2-dimensional media

behave according to a slightly different rule (Sinha & Poggio, 1996).

One very valid point that Tergan makes is that multiple representations allow for individualization of instruction and self-regulated learning. He discusses the capability of the student in a rich hypertext/hypermedia environment to access other representations, micro-worlds, explanations from different perspectives, and presentations in different symbol systems.

However, I have problems with an hypothesis that depends upon a delivery method to explain the basics of a cognitive process. I believe that a delivery method can impede learning, but I have serious doubts if it can enhance it. (Pett & Wilson, 1996). One factor that many researchers do not mention when comparing traditional learning environments to web-based environments is that students learning on the web immediately have access of all of the materials, resources, and tasks at once. In the traditional classroom, presentation of the material is very linear and parsed out along a timeline set by the instructor. In a web-based environment, students may browse the whole site, examining different elements, and tasks to see where relationships may exist, and where commonalities can facilitate their completion of several related tasks in a closer time-frame. However, this is not 'necessarily' an attribute of the delivery system. The same method of 'delivery' could be done in a traditional classroom, that would make for an interesting experiment in itself.

Piaget (1962) developed a theory of animism that he believed was pre-operational and that with the development of concrete and formal knowledge,

children's ideas about what is alive and what is not alive would reflect conventional thinking about life. Subsequent research showed that animism continued into adulthood and that many adults, who are not involved in scientific endeavors have misconceptions about scientific relationships. This is also true for adult students who need to use computers as a part of their learning.

Many students who are mature and experienced adults, believe that the computer is alive, that it can think and make decisions, that it knows when they are there and reacts accordingly, often willfully, and that it can report on their mistakes to some other entity 'lurking' within the system. This animism projects into adulthood, and this type of knowledge or 'belief' is referred to as errant prior knowledge (Pressley & McCormick, 1995). However, it then becomes the task of the teacher, not to eliminate this knowledge, but to provide students with opportunities to learn new knowledge or 'alternative frameworks' that are more appropriate to the design/development and/or usage of computers. Beliefs about and expectations of what will be experienced in the usage of computers, especially in education, can and do have an impeding influence upon acquisition of the usage and thinking skills necessary for successful and appropriate usage of computers in learning. One of the difficulties for teachers is that most often they are only informed about these beliefs by students anecdotally.

The question can be asked, "why is errant prior knowledge so enduring?" can be answered with by the fact that it has been acquired over years of experience and is consistent with other knowledge the learner possesses. If it is 'socially

constructed' then the implication is that other knowledge that the learner may have that is associated to this knowledge, makes this knowledge more difficult to change (Bruner, 1966; Vygotsky, 1930). However, there is more to this issue than the fact that the errant prior knowledge is associated to other knowledge. Research in brain processing is concluding that seemingly associated knowledge is not necessarily stored in the brain in contiguous locations but mechanisms that are in the process of further definition access 'associated' knowledge across the brain. One feature of this 'mechanism' allows patients who have suffered terrible injuries to parts of the brain, or who have had to have parts of the brain 'de-activated' are able to 'learn' new skills that the previous part of the brain processed with the remaining brain (Gazzaniga,1992; Posner, 1988; Restak, 1995; Rumelhart,1975).

Boden (1994) edits a book within which a number of well-known creators discuss various aspects of creativity for the application of technology has come as a tremendous challenge to most educators in traditional environments. As a result, those educators who see farther or more clearly what this media has to offer in terms of facilitating student learning often find themselves in opposition to their fellows, hoping to move education forward into a new era but instead castigated by their peers. This phenomenon is not new for those who traditionally generate new ideas.

In discussing creative ideas, Karl Popper states that the ability to combine two seemingly unrelated ideas may be influenced by varying levels of a particular neuro-chemical, even if the selection of the two ideas to be combined must be

explained in a different way. However, Popper makes a rigid separation between what he calls discovery and justification. The importance to him is not how the new ideas occurred but whether they can turn out to be justified. Popper also considers context irrelevant to theoretical psychology, stating that creative inspiration is fundamentally irrational (Boden, 1994).

Schaffer gives a less pessimistic, and more socially realistic view when he addresses the issue that a new idea's occurrence and its positive evaluation requires that some influential social group has to value the idea if it is to be recognized, preserved, and communicated. Schaffer delves into the fact that often the idea itself is not just one event occurring at a static moment in time, and that it involves only one person (Boden, 1994).

Merton's concept of new ideas denigrates the myth of the lone individual thinking of an absolutely new idea saying that if one didn't think of it, someone else would have and probably did. His arguments oppose the glorification of individuals presenting more of a Vygotsky'an socio-historical viewpoint. He believes that detailed consideration of alleged multiple discoveries show that there are crucial differences due more to historical contingency than to sociological determinism.

One is tempted to question whether this mean that scientific discovery is radically different from artistic discovery in that an artist may create without having to justify his creation? In considering examples of tools-to-theories heuristic, Gigerenzes states that new ideas were discovered after experimental psychologists

became familiar with new tools for data processing, rather than new data. But these new ideas then enabled the discovery of new data, measurement does not always come after the fact, but may come before it, aiding in defining the fact. What we count as creativity may partially depend on the methods we use to measure it (Boden, 1994).

In discussing the use of computers to odel the mind, Boden defines creativity in terms of mapping, exploration, and transformation of structured conceptual spaces (Mezirow, 1994). Conceptual space is a style of thinking, that can be altered in many ways, and these ways can be modeled in computational terms. Any lack in the model is the product not of the computer, but the modeler. Distinguishing valuable transformations are theoretical difficulties, not technological ones. If we are able to say clearly what enables someone to think new thoughts, we could express them computationally (Boden,1994). This belief about the possibility of mathematically modeling human thought with a computer sounds remarkably like Minsky's interpretation of the capability to successfully 'simulate' human cognition with a computer (Minsky,1986).

My objection is not to the use of computers to model the way a human thinks but for researchers, users or educators to think and accept that it is just like the way a human thinks and that ultimately a human thinks the way a computer does. This impedes research and understanding into the actual ways that humans think that may appear to have end results similar to computers but are within their own processes entirely different.

In defining what sort of person is able to generate new ideas Gardner uses his concept of multiple intelligences that he feels are more developed in some persons than in others. The attributes he cites are self-confidence, stubbornness, hard work, energy, commitment, high standards of self and others. Gardner (1993) believes that people who create ideas retain more contact with their infancy, and hold two counteracting dispositions, the questioning of every assumption, and the exhaustion of the domain. They tend to explore conceptual spaces more comprehensively and systematically before they are transformed. Gardner (1993) suggests that the exemplary creator is often not an exemplary person. Following this thought, Eyesenck suggests that creativity and contrariness may have evolved together because people who originate novel ideas need to be able to withstand the criticism of the conservative majority (Boden, 1994).

Why is the issue of 'creativity' relevant to considerations of emerging perspectives on usage of technology in education? Because it is the attributes of the 'creative personality' that are necessary for transformation of any rigidly structured discipline into a new area of either thought or practice. Many descriptions of creative people include the issue of 'risk taking', 'diligence', and stubborness in the face of discouraging events (Gardner, 1993).

Wu, et al.(1996) performed research to determine if there is a difference between technological problem-solving styles and personal problem solving styles, an issue important to teachers and developers of technology-based instructional materials and delivery system. In this study, problem-solving is defined as a

tendency to respond in a certain way while addressing problems, NOT as the steps employed in actually solving the problem (Wu, et al.,1996).

Problem solving style has also been operationally defined in three dimensions (Heppner, 1988), problem-solving confidence, approach/avoidance, and personal control. Various labels have been attached to the applied problem solving process, interpersonal cognitive problem solving, personal problem solving, social problem solving, and coping. Problem solving is frequently used in an imprecise and undisciplined manner to encompass numerous activities that are substantially different in type, focus and intent.

In the research done by (Wu et al., 1996), the questions related to whether different types of students exhibit differences in their personal and technological problem solving styles, different academic majors. Students from three disciplines, technology, engineering and humanities were used as well as from two different levels, seniors and freshmen. Also examined was relevant work experience and irrelevant work experience. They were all tested using Heppner's PSI-PSYCH (Personal Problem Solving Inventory) (Wu, et al.,1996).

The results showed no relationship between GPA, and age. Males and females were not compared because so few females responded in engineering and technology programs, so researchers referred to other reports that showed no significant difference between genders. The highest percentage of students in the study were male (67.7%) ranging in age from 17-51. Average GPA 3.02 with a majority between 3.0 and 4.0. general work experience (fast food, grocery, etc.)

average 2.37 years, technological work experience (farm work, factory, etc.) 1.73 years.

Difference emerged between problem solving and technological problem solving within the disciplines. Humanities students had biggest difference, with their worst scores on technological problem solving, and their best scores on personal problem solving. Technology students had the best scores on technological problem solving, and medium scores on personal problem solving. No internal differences in problem solving styles were detected for engineering students between technological problem solving and personal problem solving.

In comparing the disciplines on all three dimensions, Humanities had the worst scores, Engineering had medium scores, and Technology has the highest. Problem solving self-confidence was best for humanities students but not for engineering or technology students even though in other cases the other two disciplines had better scores.There was no significant difference between seniors and freshmen.

Consistent lack of difference across the three majors along personal problem solving indicates that students in all disciplines have similar personal problem solving styles. Significant differences on technological problem solving across all three academic majors suggest that students in different disciplines differ in technological problem solving styles. When the technological confidence score tended to be good, the approach/avoidance and personal control scores also tended to be good. The difference between personal and technological problem solving

styles was significant for humanities and technology. They were the same for engineering students, suggesting to the authors that there may be multiple forms of problem solving styles that may be related to the problems being solved. The results were interpreted to mean that college students are homogeneous in personal problem solving style, but not in technological problem solving style. No link was found between work experience and problem solving styles. The authors concluded that teachers and curriculum should offer more emphasis on higher-order thinking skills and technological problem solving. (Wu, et al., 1996).

Klein (1999) conducted a study that questioned the concept of cooperative learning, that is a basic constructivist theory, for application to web-based instruction. Review of cooperative learning has led many educators to conclude that cooperative learning is superior to traditional instruction for all students because it results in greater achievement by average students. Klein states that some learners are more predisposed than others to act cooperatively. The premise of Klein's research project was that evidence of student's need for affiliation may affect outcomes in a cooperative learning setting (Klein, 1999).

However, it was found that College students who have a high need for affiliation performed worse than all other groups when working alone, and had a more difficult time in applying what they had learned (Klein, 1999). One wonders if students who plan to take web-based programs are better off if they are low affiliation types.

The study used 122 subjects testing their feelings and impressions about participating in a cooperative learning exercise. All students received well designed instructional materials, and overall achievement and application were not influenced. The results showed the following:

1. Both high affiliation and low affiliation subjects who worked alone, performed significantly better on the knowledge portion of the post-test than those who worked cooperatively.

2. Both high affiliation and low affiliation subjects who worked alone expressed better attitudes than those who worked cooperatively, in thinking about future activities. (individual strategies may be more effective than cooperative strategies for enhancing motivation and learning during instructional lessons.)

3. Need for affiliation was related to attitude toward future learning activities, high affiliation students expressed positive attitudes toward future group work, and low affiliation students expressed a positive attitude toward future individual activities.

The author identified that the need for affiliation is related to student interaction behaviors, high affiliations participated in more on-task group behavior, and were more cooperative and social. Klein also states that because of this study instructors who are considering cooperative learning strategies with media originally designed for individual learning should consider student characteristics such as need for affiliation before forming cooperative learning groups.

Cooperative learning does not always increase learning from [media and materials] that have been systematically designed. (Klein, 1999).

Schneiderman, et al. (1998) at the University of Maryland identified three common patterns that they believe are important patterns of teaching and learning in the electronic classroom, (a) active individual learning, (b) small-group collaborative learning and (c) entire-class collaborative learning. They cite David Noble's work as antithetical to online instruction. Part of the confusion, they believe, is due to the large number of provocative new technologies and appealing philosophies that are being promoted. These are e-mails, chatrooms, web sites with digital libraries, CD-ROM's, specialized educational or general purpose software, video/audio conferencing, and electronic classrooms for lectures. All of these are matched by a plethora of pedagogical philosophies relating to instruction that can be expressed as follows,

- distance education, students reduce their need to travel and participate synchronously or asynchronously,
- active learning and inquiry-based learning, students investigate issues or solve problems with varying levels of human and computer guidance,
- collaborative and cooperative learning, short or long-term teamwork that support social construction of knowledge,
- service learning, students work on projects on campus or in their communities,

- individualized or self-paced learning, students work on their own using computer software that guides their progress and gives feedback,
- interactive learning environments (newer terms for computer-assisted learning and intelligent tutoring),
- learner-centered design.

Many decision makers are lured into the fantasy that teachers can be replaced by technology. However, history tell us that this is not true for books, television, and videotapes have not replaced faculty. While computer technology is empowering and it can empower teachers to aid students in learning. The relationship between the human beings, teacher and student, are still at the heart of learning. (Scheiderman, et al., 1998).

The University of Maryland's goal has been to provide faculty with an environment in that technology and a support staff can be used to enhance and transform teaching from its traditional unidirectional information flow to a more collaborative teaching/learning process with a focus that is not on the technology but rather on its use as a tool for promoting effective learning (Schneiderman, et al., 1998).

Reeves (1997) discusses the effective dimensions of interactive learning on the world wide web. The proposed model includes ten dimensions of interactive learning:

1. pedagogical philosophy,
2. learning theory,

3. goal orientation,
4. task orientation,
5. source motivation,
6. teacher role,
7. meta-cognitive support,
8. collaborative learning,
9. cultural sensitivity,
10. structural flexibility.

This model addresses a fundamental misunderstanding about web-based instruction, what is unique about it is not its media features, nor its linkages, but its pedagogical dimensions that can be designed into its delivery. (Clark, 1994).

Each of the ten dimensions of Reeve's model represent a two-ended continuum with contrasting values at either end. The pedagogical philosophy ranges from strict instructivist on one end to radical constructivist on the other. Instructivists define knowledge as separate from knowing. Reality exists regardless of the existence of sentient beings, and humans acquire knowledge of reality objectively through the senses.

Constructivists emphasize the primacy of the learner's intentions, experience, and cognitive strategies. Learners construct knowledge based upon previous knowledge combined with their experience in different learning environments. Direct instruction is replaced with tasks or problems that the individual learner has to solve. Constructivists believe that knowledge does not

exist outside the minds of human beings and that reality is individually and socially constructed based on prior experience. Rather than 'truth', learning consists of acquiring viable strategies that meet one's objectives, and at best, learning can be estimated only through observation and dialogue. However, many web-based sites are based upon instructivist (tutorial) structures rather than constructivist (tool) approaches. But there are other sites that function primarily as resources for learners engaged in constructing their own knowledge representations.

The two theories that dominate instructional design are behavioral and cognitive psychology, and in the learning theory dimension there is behavioral at one end of the continuum and cognitive psychology at the other. Behavioral psychology continues to underlay most interactive learning systems. A stimulus is presented, usually a short presentation of content. Response is demanded via a question. Feedback is given as to the accuracy of response, and positive reinforcement is given for accurate responses. Inaccurate responses result in repetition of the original stimulus or a modified version of it and the cycle begins again.

Cognitive psychologists place more emphasis on internal mental states than on behavior that include simple propositions, schema, rules, general rules, general skills, automatic skills, and mental models. Cognitivists claim a variety of learning strategies, including memorization, direct instruction, deduction, drill and practice, and induction. The WWW seems to be a powerful vehicle for delivery of learning environments grounded in cognitive learning theory (Dede, 1996).

Goals can range from sharply focused ones to general higher-order ones. Focus then varies in degree from sharp to broad. Advanced learning environments might include a blend of direct instruction with opportunities to use technology as a cognitive tool. The context of tasks is very important to adult learners. So the 'task orientation' might have academic tasks at one end and authentic tasks at the other. Most currently existing web-based instruction contains academic tasks. Cognitive learning theory suggests that ways in that knowledge, skills, and attitudes are initially learned affect the degree to that these abilities can be used in other contexts. Web-based instruction should be used to support the transfer of knowledge and skills.

Motivation is a primary factor in learning and ranges from 'extrinsic' to 'intrinsic'. Some believe that web-based instruction has the power to motivate learners because of the variety of media elements. But studies indicate that learners soon tire of these elements (Reeves, 1997). Web-based instruction can support different roles for teachers, traditional didactic 'sage on the stage' or facilitative 'guide on the side'. Web-based instruction has widened the continuum that includes the 'teacher role'. Reeves states that the learner should be responsible for:

1. recognizing and judging patterns of information,
2. organizing data,
3. constructing alternate perspectives,
4. representing new knowledge in meaningful ways.

The computer should

1. perform calculations,
2. store information,
3. retrieve information upon learner command.

When the world-wide web is used by learners as a cognitive 'tool', the teacher is a coach or even a collaborator in the knowledge construction process (Reeves, 1997).

Meta-cognition refers to learner awareness of objectives, ability to plan and evaluate learning strategies, capacity to monitor progress, and adjust learning behaviors to accommodate needs (Flavell, 1976), i.e. the skills one has in learning how to learn.

The construction of web-based portfolios is another example of how support for reflection and meta-cognition might be provided in web-based instruction. In collaborative learning strategies, dimension ranges from complete lack of support to inclusion of collaborative strategies as an integral feature. The author states that web-based instruction fosters cooperative learning, and learners benefit instructionally and socially. Two or more learners may be able to accomplish more than an isolated learner and may be just as important for learning as the interactions between learners and the web-based instruction.

Sites can be designed to be as culturally sensitive as possible. In some cultures to ask questions if inappropriate. In some african cultures to show a pointing hand is a cultural taboo because it shows a disembodied body part. Web-based instruction should accommodate diverse ethnic and cultural

backgrounds. Sites should be built upon the diversity in the population where these programs will be used so that the overall learning environment is enhanced.

Interactive learning environments can be 'fixed' or 'open'. Fixed systems still dominate and are usually limited to a specific time and place. Open systems can be used by learners independent of time and/or place constraints. The web provides opportunities for 'open' asynchronous learning, and can be designed for learning anytime/anywhere to anyone with a personal computer and a high speed modem. Fischer (1996) conducted a study that focused on human factors in the design of an ATC (Advanced Technology Classroom). The author presents the advantages of such a system in a lab where students are using computers to access the web, and at the same time are able to communicate with each other and the instructor. The lab has the capability for presenting hi-tech visuals to accentuate key points introduced in the lesson or to lay the contextual framework for higher-order thinking. High-tech visuals may vary in the degree of realism from text and graphics to digitized images, to motion videos, or to actual objects/models all of these possibilities adding an additional degree of realism to the illustration.

Given the capabilities of the system, an instructor can create/use all sorts of attention-getting visuals at various levels of realism and engage these materials to capture the students' attention and facilitate their comprehension and retention of information. According to the author, sophisticated visual technologies are extremely effective in facilitating the acquisition of higher-level concepts that are often difficult to conceptualize through verbal instruction alone (Fischer, 1996).

In the ATC, the desks are arranged in a U-formation with the instructor, projection screen, and smart lectern located at the open end of the configuration. Interactivity is facilitated by the U-formation of the desks because students have a direct line view of other students. In addition this formation permits face-to-face contact with instructor and direct contact with the learning materials. Keypad units are also supplied that communicate student's responses to structured test questions and that bring about increases in interaction on the part of the students.

Students can go, via the web, to distant locations to see the events and conditions they are studying, that situates their learning within an authentic and meaningful context. Using a variety of software packages students can use their PC's to type in their own thoughts or comments on a particular topic that can then be released for inspection by the instructor or by the class as a whole.

The author sums up her research and recommendations for the ATC as follows:

> "The concept of situated cognition and its impact on learning is currently receiving widespread attention from those who study how technology should be engaged to maximize learning. In using technology to link newly presented information to its corresponding context, the ATC is capable of providing students with the realism and authenticity they need for new information and skills to be effectively learned"(Fischer, 1999, p.69).

Bourne et al. (1997) at Vanderbilt University, studied an engineering on-line class and revealed some interesting information about the ways in that the class was successful and why. The course, entirely on-line, had 83 students, in a 3 credit EECE 274/MT274 Spring 1997 class. Twenty-six Vanderbilt alumni acted as on-

line mentors, 25 project groups were formed (4-5 people each), assignments done by the week, and 2 TA's and 2 Graders graded answers to questions submitted through a computer conference each week. All students were working on the development of their own home pages to be published on the web (Bourne, 1997). The technology used were ALN's (Asynchronous Learning Networks). Researchers and users of the system quickly revised the acronym to mean Anywhere/Anytime Learning Networks pointing out that their system is not video broadcasting. It is a full web-based system that allows learners to learn anywhere/anytime and still be part of a community of learners because ALN utilizes conferencing systems and on-line reading materials and exercises.

Bourne and his group describe themselves as having gone from the sage on the stage to a sage in the box. They also point out that ALN is much more, not only having the capability for connecting geographically distributed learners, but also to facilitate different learning modalities, permitting time and place shifting, providing rapid feedback, on-line simulations and laboratories (Bourne, et al.,1997).

The developers feel that scale-up is possible which is the ability to increase student/faculty ratio while maintaining quality education. However, studies to support this claim are not yet available. The rationale is that:

1) peer-to-peer learning is enhanced through computer conferencing,

2) answers to questions can be seen by all learners in a computer conference,

3) materials on-line can be easily modified and reused once completed,

4) links on the web to many relevant materials can easily be created to add to the richness of the learning experience, and

5) automated and rapid feedback from learning tools and answer evaluations programs can be employed.

In each of these, a cost-benefit exists. If students in large classes learn from each other, the need for an instructor and teaching assistant is reduced (Bourne, et. al., 1997). At this point I believe that this latter statement is unproven.

The authors also describe their ALN as providing technologies for computer conferencing, submission of homework, discussion of issues, help, online materials, course management, interaction with other students and audio and video clips with downloadable audio. (Bourne, et al.,1997).

One of the authors' objections to many courses that are offered online is that there is little more than a syllabus, and a list of assignments. However, in examining other research, it becomes apparent that one of the elements that education departments need in converting to online instruction is support by the university and the community. I was astounded to see the low 'teacher/student' ratio of the Vanderbilt project. This no doubt was extremely facilitative in the development of their web-based model. Also, but not most importantly, it was developed in the Engineering Department, that would most likely have a basic technological orientation.

Thomas Cobb (1997) argues against the theories of Richard Clark regarding the role that media play in the delivery of instruction on the basis of cognitive

efficiency. Clark has argued that media used to deliver instruction has nothing to do with cognition and learning because any number of media are equally capable of delivery of any instruction so that media choices are about cost and efficiency, not about cognition and learning (Clark, 1994).

Cobb responds by arguing that if one type of efficiency is about cognitive efficiency then it follows that media choices are often about cognition and learning and can profit from an understanding of cognitive processes. Cognitive efficiency is a measure of how much cognitive work is performed outside of working memory in a given task by a symbol system or culture. Efficient instructional media are symbol systems that do some of the learners' cognitive work for them. However, the most efficient medium would not necessarily be ideal for every stage of learning (Cobb, 1997).

Clark again states that the contribution of a strong media could have been made by any number of media choices. If efficiency is expanded to include cognitive efficiency then media choices become connected to learning in some circumstances. Clark believes that there are no learning benefits to be gained by using technological media to deliver instruction. Two important ideas in early cognition are that,

> one: symbol systems are caused by, but do not cause cognition, and
>
> two: all interesting cognitive representations and computations exist within individual minds.

An instructional medium can be seen as a collection of stimuli organized for maximal associative learning (Clark, 1994).

Cobb counters that it was probably inevitable that the cognitive attack on stimulus-response would entail a diminished status for instructional media in educational theory, pointing out that one of Richard Clark's early projects was to break the link between "educational technology and behaviorism-based audio visualism" (Cobb, 1997).

Cobb continues by arguing that theorists in literature and art history have long held that information codes such as painting, music, or particular forms of literacy played causal roles in human cognition. Early cognitive research focused on performance, and did not entail learning theory. Cobb further uses the analogy that a classic example of external symbol systems that do cognitive work is the use of Arabic numerals for multiplication. Arabic notation is cognitively efficient for multiplication because it does some of the cognitive work involved.

Efficiency as a concept, can be measured only against an objective, short-term efficiency of learning against long-term efficiency of use. The mind processes shapes and pictures faster than it does graphemes, e.g. Chinese is more efficient than Roman characters, but Chinese has a longer learning process (Cobb, 1997). Learning the characters progresses over many years. So, efficiency of eventual performance must be weighed against efficiency of learning. There is no established methodology for studying the phenomenon in general, much less one that might be adapted to media studies. That is why media researchers interested in

distributed cognition rely on qualitative-descriptive approaches to their subject. However, there is one step toward an empirical methodology of distributed representation. That is a representational analysis consisting of identification, separation, and principles of reintegration of all the internal and external representations and computations that are relevant to a particular cognitive task.

I could ask the question here whether the virtual classroom in the PTE program serve to provide a contextualized schema within that the result of reflection or cognitive processing of the task achieves cognitive efficiency. There is no fully elaborated learning theory from that a media theory can follow. And, is a media theory the real issue for selection of instructional delivery systems or has it been made into an issue by Cobb in connecting the concept of cognitive efficiency to it.

Hill and Hannafin (1997) describe what they call, OELE - Open-Ended Learning Environments, as learner-centered systems that facilitate the unique efforts of individuals, versus transmitting uniform information to a class or group. In the following study, subjects were tested for knowledge in three domains, meta-cognitive, system, and subject. The results are that:

(a) a variety of strategies are used by learners,

(b) self-reported knowledge seemed to affect the strategies used, and

(c) perceptions of disorientation and perceived self-efficacy influence the strategies used.

Implications related to OELE and emerging information technologies were considered. The purpose of the study was to identify strategies used by adults seeking to address individually defined learning needs via the world wide web. This medium has expanded online access to a theoretically unlimited number and type of multi-media documents, dynamic indexing among documents, and powerful search engines that assist users.

The authors appear to favor embedding the teaching of a learning strategy within the OELE when they state that "learning a discriminating use of the web documents and evaluation of their value needs to be one of the learning steps" (Hill & Hannafin, 1997). They state that OELE's are designed to facilitate problem-solving, critical thinking, and perspective building as learners engage in resource-rich environments. The extent to that the WWW supports learning depends upon the extent to that relevant pedagogy is embedded within a given Web site, or the degree to that scaffolding is provided. The depth of each of these depends upon the design and/or context of the application.

The authors conducted a study on communication, psychology, systems design, computer science, and information science to determine the elements most likely to influence user-centered, open-ended learning. They found five key factors:

1. Meta-cognitive knowledge or awareness of one's own cognitive processes: chunking, scanning, searching, questioning, generating hypotheses, making decisions. These cognitive processes allow individuals to reflect, evaluate, and direct cognitive activities effectively. However, the decision -making and

management demands of the world-wide web can be considerable. Mega-cognitive knowledge presumably influences how or if individuals identify and monitor their learning needs, skills that are considered fundamental to open learning. Weak skills limit learners while strong skills facilitate learner's success.

2. Perceived orientation, awareness of one's location within a system as well as strategies and activities needed to navigate the system, that include the student's ability to recognize location, and gain bearings in a system that influences success. Disorientation or feeling of being lost in hyperspace hampers student learning. Even modest disorientation may present a challenge for the learner.

3. Perceived self-efficacy, refers to personal judgement of one's capability to execute actions and to perform. Self-efficacy influences choice. Given appropriate skills and adequate incentives, efficacy expectations are a major determinant of people's choice of activities, how much effort they will expend, and how long they will sustain effort in dealing with stressful situations. These factors toward hypermedia information systems affect whether people are likely to use the system. Users with high self-efficacy tend to be more persistent in searching and confident in ability to locate resources that they need.

4. Systems knowledge, prior knowledge and experience with a particular system closely related in structure and function. High systems knowledge enables strategic and sophisticated uses of search and retrieval features. Low systems knowledge often reflects lack of awareness of how systems work. Lacking prior knowledge, users had difficulty Communicating with and through systems.

5. Prior subject knowledge. existing knowledge in the domain in that one searches, an individual's organization, stability, and clarity of knowledge in the subject matter field is principal factor influencing learning and retention of meaningful new material independent of the media. Students with extensive prior content knowledge outperform those without. High domain knowledge allows students to generate powerful strategies that are largely independent of specific information systems. Information systems extend inquiry via schema-driven searches in a familiar domain rather than assist the acquisitions of enabling conceptual knowledge or skill (Hill & Hannafin, 1997).

There is a need to understand the processes learners use to search, and how the system searches. Also the question needs to be answered whether all of the five above elements affect the learning strategies employed. OELE, as described above, reflect the following course philosophy:

1. Within educational settings, technologies are tools to be used to build or construct.

2. Productive use is influenced by context, audience, and activity. While the classroom is teacher-centered, various technologies can support student-centering. Participants established own relevant goals to be pursued, as well as steps needed to attain them.

3. Concrete, relevant contexts establish both everyday referents and the meaningfulness of learning activities. Individuals identify specific problems with their working sites.

4. Underlying processes associated with technology applications are critical for developing understanding because existing technologies will inevitably be replaced. Therefore, problem solving using available tools was stressed rather than mastery of specific software and hardware (Hill & Hannafin, 1997).

Flavell (1976) discusses the issue of meta-cognitive awareness describing meta-cognitive experience as any conscious cognitive experience that accompanies and pertains to an intellectual enterprise. The manner in that meta-cognitive experiences are processed impacts whether or how meta-cognition influences action. One example of use of a meta-cognitive influence is when one is struggling with a problem, and suddenly realizes the way in that a similar problem was solved. Awareness of distance from a goal is not, in itself, a meta-cognitive awareness: What the learner does about the feeling is meta-cognitive. The question is whether our action is guided and influenced by our meta-cognitive awareness.

A student's prior subject knowledge can influence and be influenced by prior meta-cognitive knowledge. Employment of meta-cognitive knowledge can be impaired by other factors, disorientation, frustration, and impatience. This is consistent with observations that successful learners assess situational requirements and develop plans to deal with them.

Hill and Hannafin (1997) examined OELE's and identified the significant issues as: Disorientation, Integration, and Angling: (viewing new information from various perspectives), that play a role in the potential usefulness of information. Learner Control varies according to learner aptitude and prior knowledge. Too

extensive learner control may inhibit success in some electronic environments, since learners do not select wisely when given open-ended choices. Choice appears to affect success in OELE's, thinking and processing information, and traditional versus open-learning environments.

Conventional school activities encourage 'compliant' thinking, because traditional education has been externally managed and teacher-directed. This creates a fundamental problem for OELE's that emphasize exploration and learner-centered thinking. Traditional methods may engender generations of learners who are ill-equipped for OELE's, where individual control, divergent thinking, multiple perspectives, and independent thinking are crucial (Driscoll, 1994). The epistemic beliefs or general assumptions that students hold about the nature of learning may prove to be the root issue in the utility of complex, open-ended learning (Spiro, et al.,1993).

Effectiveness differs among learners with different epistemic beliefs. Efforts to foster divergent thinking and multiple perspective building, as well as critical thinking and problem solving, are needed to assist learners in adapting to these environments. These environments need to better support learners in becoming critical (Hill & Hannafin, 1997)

Sinha & Poggio (1996) conducted research, important to web-based instruction that suggests that certain types of perception are learned and their research relates to the observation of three-dimensional objects in a two-dimensional format whether seen directly with the eye, from a sheet of paper, or

seen as an object on a television or computer screen. Their study tested the theory that our learned perception can affect how we see similar objects at a later time. Sinha and Poggio's experiment shows that the human visual system can learn associations between arbitrarily paired two-dimensional pictures and (projectionally consistent) three-dimensional structures. Results implicate high-level recognition processes in the task of shape perception. The primary question was how the 3-D structure is represented by the visual system, considering two main possibilities.

1. 3-D structures represented explicitly as an object-centered CAD-like model, or

2. 3-D structures represented implicitly as a viewer-centered depth structure coupled with knowledge of how its projection transforms upon rotation about an axis.

The results of their two controlled experiments lent support to the idea of implicit 3-D representations (Sinha & Poggio, 1996). Subjects were able to recognize the objects when they were shown at the same angle of rotation. They were not able to recognize them when shown at a different angle of rotation about the axis. What this told the researchers was that a viewer of a 3-dimensional object rotating on an axis internalizes an image that can then be applied to recognizing a similar object at the same angle of rotation. However, this knowledge is not transferable to a similar object at a different angle of rotation (Sinha & Poggio, 1996).

(Pett & Wilson,1996) also present an interesting discussion of color that is extremely useful for designers of instructional materials, especially web-based instructional materials. Color may be viewed from three different perspectives, visual, psychological, and physiological. There are three definitions commonly used to describe color, hue (common name of color), value or brightness (amount of light that is reflected or transmitted), and saturation or chroma (degree of pure color in sample).

Computer generated images are not of consistent hue throughout, but are darker at the edges and lighter in the middle. This aggravates the learner's visual system, for the human eye is constantly attempting to accommodate to what the retina is receiving so that the image is sharp and clear. This is called 'acuity'.

Color is of value to humans in a number of ways. One is allowing humans to discriminate an object from its background where intensities and textures of objects are the same. Animals rely on movement to help them differentiate objects or other animals in the foreground from their background but humans can cognitively compute differences in distance between two stationary objects, as well as computing differences in distance between a moving object and its background that may also be moving. This capability is one of the advantages of human's 'stereopsis', that is the viewing of the same object with two eyes from slightly different perspectives.

Color is almost never seen as it is. It is greatly affected by our expectation of what the color will be for people have norms for colors of familiar objects.

These norms are independent of the texture or the light that is falling on the object. Another factor affecting the way we see color is the context in that we see it. Hues change based on that ones are seen with it, or are seen sequentially. This phenomenon is directly related to the three ways that our eyes adapt to color, general, local, and lateral (Evans, 1943).

General adaptation occurs when a human moves from indoor light to outdoor light, that is bluer. But when a person moves back to indoor light again, they become sensitive to blue again and a white or gray surfaces appears neutral. (Evans, 1943).

In embedding color in web-pages, the designer has to deal with the color that might be displayed by the learners computer screen, or printer. Some colors don't print out, or may not be displayed because they are not within the pallette of the learner's computer monitor or printer. For example, a the marbled-gray background on one screen completely washes out on another.

In computer generated images the negative space in the design of the pages between and around the text is an image itself, as well as the text and the graphics on the page. The interspace images can be distracting by themselves, or can create an image that suggests something different merely by its shape (Rieber, 1995).

Local adaptation is demonstrated by afterimages. When the eye is fixed on a color target the eye re-adjusts its sensitivity to the color in and around the target. This adaptation does not affect the color viewed, but will affect the next color viewed in the direction of the color that is complementary. In looking at a red

object for a few seconds and then looking at a neutral color, a blue image will appear.

In the early days of computer monitors, the screens were green with white print. When used for long periods of time, white colors appeared pink when the user looked away. This afterimage of color has been known to remain for several hours. Also, when looking at a red color for a few seconds, and then looking at yellow-green, the object appears more green than yellow because the yellow is modified by the blue afterimage. Afterimages are more pronounced when the target area color is highly saturated.

One of the major problems with a computer image is that it is bright at the edges and dimmer in the center that interferes with the eye's capability to focus at the correct distance. The image falls in the foveal area of the retina, that is the central area of the retina. This allows for acuity, or clarity in perception of the image.

Lateral adaptation is the effect when two colors are viewed simultaneously. The perception of any color is affected by the color, hue, or saturation of any color adjacent to it or surrounding it. Grey on black looks lighter than the same grey on a white background. Any color will look lighter next to a darker color or darker next to a lighter colors. Two colors adjacent on the color wheel, will appear to shift away from each other when viewed side by side. Yellow and orange viewed together tend to cause the yellow to look greenish, and the orange to look reddish. Also, any color will look more saturated on a background of a complementary

color or gray, than it looks with a background of color that is adjacent to it on the color wheel, red on blue looks more saturated than red on yellow. Maximization of a color is visualized when it is seen against gray that is of the same value (Evans, 1943).

Acuity is defined as the keenness of perception and is measured by the 20/20 type scores on eye-chart readings so that a person with 20/20 vision has keener vision than someone with 20/30, etc. In testing a group of students from second grade to twelfth grade found that acuity decreased in proportion to the distance from the yellow locus of the spectrum. Research also found that acuity was better for colors in the middle of the spectrum rather than at the ends. Where legibility is critical, background colors from best to worst were: (1) white, (2) yellow, (3) green, (4) red, and (5) blue (Pett & Wilson, 1996).

Another study that used white, and three values of brightness for each of bue, green, red, and yellow were used on a black background. Greatest acuity was achieved with white and the three values of yellow. It is speculated that value was more important than hue.

Lettering is more legible with a neutral background than with a colored background of the same transmittance. Color coding is detrimental to a learner's comprehension when there is light loss because of color backgrounds affecting legibility. Brightness contrast is most critical in legibility. Thus the effect of the color itself is not as significant assuming proper lettering size and projection standards are sufficient.

Gustin (1990), and Cutthill (1991) did additional research in acuity proving that acuity is greatest for colors in the middle-range of the spectrum. Both used white lettering on a colored background. Cuttill used images project on a CRT while Gustin used projected slides. Gustin found that across three background densities, yellow and blue were significantly better in facilitating legibility than red or blue, and green was significantly better than blue (blue is toward the violet end of the spectrum). Cuttill found that yellow, magenta, and blue provide the best legibility. The hues in the two studies were not the same but the variation would not seem to account for the difference in conclusions. More study might turn up the reasons why there was a difference (Pett & Wilson, 1994). My question would be whether the difference could have been caused by the different media used to create the image, projected slide image as opposed to CRT image.

Color deficiencies exist in some extent in 7% of all males, and 5% of all females, and males are more likely to have red-green color blindness than females. Color-deficient persons tend to confuse red and green with yellow. Reds and greens of similar value and all colors of high value tend to cause confusion in color-deficient persons. Increasing hue contrast tends to increase discrimination. That is, using colors that are opposite or nearly opposite on the color wheel rather than colors that are adjacent. However, the most important cue is value contrast. A value contrast of 30% or more increases color-deficient viewers abilities to discriminate colors (Pett & Wilson, 1996).

Guilford (1964) showed in his research that hue determines preference or affective value of 67% for women and of 16% for men. Value or brightness determines affective value of about 20% for women and 5% for men. Saturation determines affective value of 5% for women, and 13% for men.

Color preferences vary from individual to individual and relate to personality. There is evidence that color preferences change with age and are influenced by cultural and individual characteristics. The selection of color to be used in a web-based instruction can have a significant effect on the viewer if it is a color that is identified culturally with some attribute of learning, special meaning, or personality. Preferences for background color have also been measured and affect students engagement with material on a page and length of time they will work with it (Pett & Wilson, 1996).

In 1979 a study was done to determine if the presence of color television sets in homes would make a difference in learning, black and white versus color. 318 persons in 4 groups were studied and no significant difference was recorded. Penn State also did a test on 60 students and reported the same results (Pett & Wilson, 1996).

With computer technology introduced into classroom instruction, and with web-base instruction dependent upon computer technology, generated images and the colors and shapes used to express the instructional content become very important issues related to learning, association, and cognitive processes.

Lyskawa (1999) examines semiotic vs. traditional hyperlinks on learner satisfaction and performance. Psychic engineering phrased by Ted Nelson in 1965 is the manipulation of human-computer hyperspaces. Text, images, and their links that could not be efficiently represented on paper can only be represented in hyperspace because it also includes the mental conceptions and space structures among that the user moves. Nelson felt that such an environment, if properly designed, could have great potential for education, increasing a student's range of choices, sense of freedom, motivation, and intellectual grasp.

Lyskawa states that the risk of fragmentation also increases and is caused when a learner gets lost in hyperspace and wastes time wandering through a program. When a feeling that loss of choice and freedom grow, fragmentation increases proportionately. As a result, it is the responsibility of the instructional designer to reduce the amount of time lost by learners by utilizing the best interface design methods applied to instructional design. Providing learners with additional levels of information in the form of navigation aids through content structures in the hypertext environment is crucial (Lyskawa, 1999).

Lyskawa (1999) describes semiotics is the study of signs seeks to understand how signs perform or convey meaning in context. The study of semiotics can also be used to explore the interaction between educator, web program, and learner, with concentration on the exchange of messages, content and expression levels. A hyperlink used within a web instructional program is an example of semiotic 'unit of analysis'. For a program's navigation to be effective,

hyperlinks must be interpretable by the learner enabling them to move from a position of lack of recognition of the program navigation possibilities, to an interpretable and navigable representation of the program.

Lyskawa (1999) sees the issue between semiotics versus traditional hyperlink as partly due to the fact that text characters are highlighted in a different color than the surrounding text, usually bright blue and are the same whether the link is internal or external. This is confusing to the user because the only way to determine whether they are internal or external is from the context. Semiotic hyperlinks are a combination of both graphical and textual elements.

In Lyskawa's (1999) description it appears that the special buttons have 'text' characters on them to identify what they are DEFN links to an internal site, while WEB LINK links to an external site. He also refers to the 'semiotic triangle' that is the user, the learner, and the program. Graphical links are considered an advantage because they can communicate a higher level of information, and they can be processed by users more quickly.

Lyskawa (1999) performed a study to compare semiotic and traditional hyperlinks using 300 students, 132 of whom participated in study. He used two forms of hyperlinks, one group received a traditional web hyperlink format, (text only), the other received a semiotic web hyperlink format, a button with image and text. There was a significant difference in user satisfaction between types of hyperlink used and a significant difference between levels of web experience and

learner satisfaction. In terms of performance there was no significant reason to use semiotic hyperlinks.

Lyskawa (1999) interpreted the research as showing the issue to be one of time, users needed more time to interpret the sign systems. With the combination of text and graphics, 'think time' was much higher than for text alone. A high level of previous web experience mitigated the time issue only for experienced students who already knew how to 'move' around the web. The question arose whether advanced users may be interpreting the iconic representations 'after the fact' rather than 'before the fact'. If the interpretation is after the fact, then the button with the text and graphics are not instrumental in aiding students in navigation of the web.

Learner satisfaction was different between beginners, intermediate and advanced students based upon experience levels. In this case it was difficult to determine if lower satisfaction levels were due to iconic representations or lack of previous experience. The end results of the study showed was that replacement of traditional text hyperlinks with semiotic hyperlinks made no significant difference in performance.

Learners did prefer GUI interface (graphical user interface) that the author hypothesized could enhance satisfaction without hurting performance. The author hypothesizes that the lack of performance gains may be due to shortage of time for users to incorporate new sign systems into their 'language' and performance may improved with repeated visits. However, the research made it clear that the use of

semiotic hyperlinks for experienced users slowed performance on the first try, and impeded performance for inexperienced users (Lyskawa, 1996).

METHOD, DESIGN, & PROCESSES OF RESEARCH

Method & Design

I have chosen to do a qualitative study more specifically a Naturalistic Inquiry, that is defined as studying real-world situations as they unfold with openness to whatever emerges (Gay & Arasian, 2000). Because I am researching adult students' learning strategies, it requires a certain self-awareness and conscious meta-cognitive functioning on the part of the student. Since it is impossible to determine ahead of time the degree of an individual student's self-consciousness about their own learning, it is often not possible to get the needed information from one direct question.

Because of this seemingly indirect method of arriving at a synthesis of information gained from several questions, a naturalistic inquiry is believed to be the most productive of useful information regarding adult student learning strategies. My conclusions will follow from the evidence acquired directly from the students themselves, their own words examined in consideration of past and emerging research regarding the development and/or transformation of adult student learning strategies (Mezirow, 1994).

A method of naturalistic inquiry is consistent with my epistemology and attitudes about research of human subjects. Guba and Lincoln (1994) argue that the problem with quantitative approaches is that the precise focus on a narrow subset of variables strips other variables existing in the context of the research that would, if allowed to be examined as well, might alter the final result of the study. Their

question goes directly to my concern over what I call the paradox of the interface, those areas between the subsets of data or at the edges of the intervals between them that might alter our final conclusion (Lansdale & Ormerod, 1990; Preece & Keller, 1990).

Qualitative data can have the effect of correcting the imbalance of strictly quantitative data by providing contextual information. It can also alleviate the ambiguity of applying generalizations to individual cases (Guba & Lincoln, 1994). It is, I believe, this contextual information that is necessary when applying research conclusions to human behavior. If we are to accept our own and others uniqueness then we have to accept that the differences will be many and varied and as a result requires a methodology that allows for expression of the variability. I thus believe that the best expression of that variability is a student's own words.

Gaining access to knowledge regarding adult student learning strategies is of necessity indirect. Even physical examinations such as behavioral experiments and brain scans only provide us with fragments of a total picture of learning and cognitive processes. Relying upon questions to students and the necessity for the researcher to formulate the appropriate questions, ask them in a manner eliciting the most information and relying on students to be self-reflective and meta-cognitive about their learning processes presents the fragmentation from the another perspective.

I have collected information from adult students regarding their learning strategies using different techniques; a questionnaire, follow-up questions to the

questionnaire, and self-assessments which students completed upon submission of their capstone tasks for each module. Since my data collection took place over one academic year and two additional terms, and involves re-asking similar questions as well as using two different data collection instruments, I consider my data collection techniques to be varied enough and space in time enough to capture a cross-sectional perspective from the students of their usage of learning strategies in the program over time.

Researcher & Teacher

As a Researcher, I believe an important consideration worthy of some brief discussion is the fact that I am both researcher and teacher for this project. Web-based instruction takes place in the dynamic environment of the web and while large changes are not made to the curriculum once a course has begun, maintenance or enhancement of the environment often necessitates change.

The Professional Technical Education (PTE) Program is experimental and the necessity of responding to emerging needs is an integral part of program. Over the past two years I have been aiding in the evolution of the program and its web pages for purposes of improving student learning and interaction, then making necessary changes to the pages, teaching the modules, evaluating student work, and interacting with students via e-mail, all at the same time. In essence, changing the environment and the content was changing, at the same time I was teaching it and performing research on it.

The first time I realized that I was thinking about changing something to see what would happen, I realized that I had a conflict of purpose. I had no proof whether my proposed changes would have had a positive or negative affect. I was treating it as an experimental exercise. That is when I realized that the issue regarding what I could learn from a research perspective was injected into my teaching formula. As a result, I also realized that as researcher/teacher I had two objectives instead of one. They were not necessarily compatible. In fact, most likely they were conflicting, or at best contradictory.

In the process of reflecting upon this dilemma I came upon an article by E. David Wong (1995), an Assistant Professor in the College of Education at Michigan State University. His areas of research are the nature of scientific thinking and practice, analogical reasoning, and reform in science education .

Wong's research is qualitative and descriptive but he comes to it with the bias of a quantitative researcher. My research is also qualitative and descriptive and I come to it with the bias of a qualitative researcher. Although he and I are in different disciplines, and teach at different grade levels (he is teaching middle school students), our main commonality is that we are studying learning from the student's perspective, not from the teacher's perspective. And I share with him what he calls in his article concerns about conflict of purpose and conduct (Wong, 1995).

Wong frames his concerns by referring to Aristotle's *Nichomachean Ethics* where a distinction is made between the theoretical and practical sciences (Aristotle, 384-322 B.C). For Aristotle the word science had a slightly different

meaning than it does today. He used this term to identify any part of human activity, conduct, production, speculation...insofar as it is alive with true thinking (Wong, 1995).

Aristotle defines the practitioner of the theoretical science as the spectator, outside the events, observing and understanding through observation and reflection, making no attempt to change either the process or its result. Wong calls this the role of the Researcher.

Aristotle defines the practitioner of the practical science as a part of the change, making a deliberate decision or using a specific plan to produce action or change in the process, often initiating and controlling the variables for change. Wong calls this the role of the Teacher.

Wong argues that in teaching, moral imperatives are more than a code of ethics that regulate the activity of instruction. Teaching means to act morally, treat the students with compassion, and to provide them with experiences that are of value. To educate is to lead responsibly, to influence student's knowledge, skills, and dispositions in a way that will serve them and their society (Wong, 1995).

The philosophical underpinnings of certain forms of action research have a direct relationship to Aristotle's attempt to contrast the distinctive features of research with practical activities such as teaching. Wong states that it is difficult to understand teaching adequately from the perspective of an outsider. The inextricable relationship between action and understanding is central (Wong, 1995).

Many would argue that to really understand the practice of teaching, one must have tried to teach another (Wong, 1995). I must admit, I cannot disagree with this statement. However, the question then becomes does it serve the researcher/teacher better to try to meld the two purposes and conducts into one, keeping them separate and giving each equal value evaluating specific situations and deciding that would take precedence within a given set of circumstances. Or, should one stance be given precedence over the other?

Suzanne Wilson, who is a teacher of social studies, also in the College of Education at Michigan State, disagrees with Wong's position arguing that one teacher/researcher's tension is another's intention (Wilson, 1995). She argues that to separate the two as definitely as Wong has, is to say that the intersection of the two roles based on who produces knowledge becomes political, conceptual and epistemological. Her argument focuses on her belief that teacher/researchers are attending to both functions at the same time and she states that her teaching IS the experiment. She interprets Wong's position as pitting the concerns of the teacher in opposition to the concerns of the researcher. I do not read Wong this way. I believe that what Wong is saying is what I have experienced in a similar situation, and that is that the purpose of the research and of teaching are different enough that attempting to perform both at once can and often does lead to conflict in conduct. And it is to the researcher/teacher to determine how to resolve this conflict. Wong resolves his conflict by renegotiating the culture of the classroom within that

he can deal with his need for control in the research sense while at the same time dealing with the loss of control in the teaching sense.

I have given this question considerable reflection. I had begun to think that melding the two and giving each consideration based on a specific situation would work, when an event occurred that changed my mind and gave me the perspective I have taken in this study.

One of my students in PTE was having a very difficult time synthesizing his reading and his experience in his practicum into a cogent, and substantive capstone that he needed to submit to satisfy completion of one of the classes.

I knew of a strategy that I thought could help him, but I had to ask myself, what if I give him the learning strategy? Then it's not his, its mine and I'm in the middle of collecting data about student learning strategies. Should I say nothing, in order to get data, that was un-corrupted by my involvement? Or, should I tell him what I know and then account for it when and if I come across it in the data I collect from him?

After some reflection I realized that my involvement as researcher and teacher already precluded getting any uncorrupted data. So, I decided that I could not stand by and watch a student struggle for want of a tool that might be helpful. I gave it to him. In the process of my research where the conflicts of purpose and conduct arose, as in the above example, my role as teacher had to come first. However, I would call attention to my action in my dissertation and explain why I did what I did.

Another issue that must be dealt with in this research is that as a researcher, I am a person coming to the process with my own personal schema already developed. Although we also change as researcher/teacher in the process, we largely remain the person we were. In fact, it is impossible, maybe even undesirable, to attempt to divest ourselves of our personal schema. However, those schema, that might be called bias, should be made explicit within the context of the research (Borg, et al, 1981). Following is a brief description of who I think I am as a person, and how that who may have affected my thought processes and my perspectives in my research.

As a Learner I tend to see for patterns. I also look at the big picture as well as the details working top-down and bottom-up alternately. I achieve new constructs by de-constructing old ones, designing new ones, examining, developing, and constructing or re-constructing. I think of myself as a transformational designer occasionally creating something new in the process. I see everything as related to everything else, an interconnecting and cyclical series of symbiotic relationships.

As a Person, I am a white female born in 1935. My parents both attended university, my father graduating from Loyola in Chicago and my mother attending University of Chicago. My grandmother who revered education more than any other single thing raised me. Learning has fascinated me since I was five and played school. Computers have fascinated me since I was ten and my stepfather, who worked for IBM, let me stack punched cards and put them in the card sorter.

I have several other areas of lifelong interest that I have pursued formally and informally, natural history, history, and fine arts. I consider myself to be a social scientist who also teaches people to use computers, that I've been doing since 1965. I have four grown children and a neice who I consider to be my primary support system and who keep me grounded when I'm in danger of becoming too philosophical or abstract.

As an Educator, I have worked in industry training people to use computers and systems, in Education I have trained adult students to design systems, and as an independent consultant I have helped people learn how to use the hardware and software they have purchased. I see all adult learners as having different cognitive styles, different intelligences (Gardner, 1983), different cultural perspectives, and physiological anomalies that affect perception and learning (Hubel, 1995; Kandel, 1995). As a Learner, I remember something better and longer if I can see it written down or see a picture of it, or if I can make my own picture of what something represents to me.

I also tend to be very interested in what can be known about those things, that are left out of our descriptions, drawings, and conclusions. I consider myself to have several theoretical perspectives encompassed within a post-modernist, existential epistemology. These several theoretical perspectives are:

- Cognitivism - when teaching students to mentally synthesize the functions of the computer and the software with the course content and objectives in order to achieve a higher level of understanding and performance in the

overall learning experience, relying on research regarding the mental processing of information, its acquisition, organization, coding, rehearsal, storage in and retrieval from memory, and forgetting (Ausubel, 1978; Bandura, 1986; Bruner, 1964, 1966, 1973; Mayer, 1992).

- Behaviorism - when teaching students to use computers, that requires performance of physical functions, acquisition of certain rote skills, and repetitive actions that become automatic, relating primarily to Skinner's theories regarding voluntary behavior relative to discriminant operants and their controlling stimuli (Skinner, 1953).
- Constructivism - when encouraging students to take responsibility for their own learning, and their becoming an active partner in developing their own learning strategies and learning tasks (Von Glasersfeld, 1984).

Although not considered theoretical perspectives in the same sense as cognitivism, behaviorism, and constructivism, my thinking and research have also been greatly influenced by my readings and interest in information processing theory, and physiological and psychological theories. A brief description follows.

- Information Processing theory - when considering the all encompassing processing requirements of students to understand and process information from the two disparate worlds of ideas and functions (Rumelhart, et al., 1975, 1986; Simon, 1996).
- Physiological & Psychological Theory - when considering the physiological aspects of learning relative to brain processing and the

subsequent result of external conditions or physical anomalies that affect learning. (Gazzaniga, 1988, 1992; Restak, 1984, 1995).

However, no matter how well prepared I am as a researcher I cannot conduct my research without a group of research subjects to study and it is these research participants who give the true form to the results of any research project.

Research Participants

My participant population was made up of adult graduate students in a Web-based Professional Technical Education (PTE), Teacher Licensure Program offered by the School of Education at Oregon State University. The PTE program is presently the only one of its type in the state, and was developed under the auspices of the Teacher Standards and Practices Commission (TSPC), that is the licensing agency for teachers in Oregon. Presently the PTE Program offers initial in Business Education, and Technology Education at the middle school and high school levels.

The program began in September, 1998, and the first year ended in June, 1999. The second year began Fall Term, 1999. The average age of students in the program is 38.5, and are seeking initial licensure in either Business Education or Technology Education at the Middle School and High School levels. All students must also have bachelor's degree and 4000 hours of work experience in their subject areas to be considered for the Program.

The program is comprised of 15 one-credit modules covering the basic and advanced knowledge important for content specialists who are pre-service teachers to become licensed and ultimately become professional educators. Students in the program must take 15 one-credit practicum. In their practicum experience students observe and participate in a classroom in a public school near their homes under the guidance of a mentor/supervisor who is an experienced teacher in their subject area and at the level they will become licensed. The module content and the practicum are aligned and students discuss their academic work in the modules with the program instructors, each other, their mentors, and other teacher educators at their school site.

In addition to their academic work and their in-school practicum students take 4 credits of seminar that are face-to-face and one is held each term. As students near completion of their program they must have satisfy Oregon's test requirements for teachers, Basic Skills, MSAT, and Professional Knowledge. Upon completion of their modules and practicum, students must take 9 credits of Internship where they are in the classroom full-time for nine weeks actually teaching in their subject area under the supervision of their mentor/supervisor.

To finally complete the PTE Program, students must create two work samples each containing nine lesson plans, a portfolio, a video of themselves teaching one of their lessons in their classroom, and pass an evaluation by a committee comprised of a professional from their field, their mentor/supervisor, and the Director of the program from OSU.

Of the current PTE Program population of 14 students, 12 agreed to be a participants in the present study, 5 females and 7 males. Four entered the first year of the program in Fall 1998, one entered Winter 1999, two entered Spring 1999, 4 entered Fall 1999, and one entered Winter 2000. Participants in the study were all seeking initial licensure in either Business Education or Technology Education. A chart showing the demographics of the particpants can be seen in the Appendices (Appendix A).

Students in the PTE Program are self-selected and a convenience sample to the extent that the PTE program is an experimental one and students entering agree to become part of the ongoing research regarding the program's functioning. However, for this study students were given the option of participating or not. Two declined leaving an actual participant population of 12.

PTE students may be pre-service teachers, or they may hold one of two temporary licenses, Transitional or Special PTE license. Satisfaction of their practicum teaching can be done in one of three ways depending upon whether they have one of the temporary licenses or not.

- as a pre-service teacher in a practicum mentored by an experienced subject-area teacher at the site, and supervised by the Director of the PTE Program,
- as a "transitional" license holder in a full-time teaching position mentored by an experienced subject-area teacher at or near the site, and supervised by the school's principal, or

- as a special Professional/Technical license holder in a full-time teaching position mentored by an experienced subject-area teacher at or near the site, and supervised by the school's principal.

Since all students in the program are older than 25, with prior experience in either a technical workplace or professional workplace, they have varying degrees of computer competence beyond the beginner level. All have computers at home from that they use a Web browser to access the program site. All tasks, capstones, discussion, and dialogue are submitted through the web site or via e-mail.

Data Collection & Instruments

I believe that the data collection instruments I utilized are appropriate to the nature of the instruction that the adult students are receiving (Brandt, 1981) in the Web-based PTE Program. Following is a brief description of each and how the instruments will be used. Samples of these instruments can be found in the Appendix.

- Questionnaire - The questionnaire was handed out to students at the Winter Term Seminar and were returned by them as files attached to e-mail messages to the PTE mailbox. All twelve questionnaires were returned with answers to all of the nine questions.
- Follow-up Questions - Six follow-up questions were generated for each student and sent to them via e-mail. All students responded to the follow-up questions.

- Student Self - Assessments for each Module - Self-Assessment has two parts, a four part ranked rubric for Theory Into Practice, Reflection & Synthesis, Resources & References, and Presentation Mechanics that are graded as Exceeded (A+), Met (A), Met With Difficulty (B), Not Met (C), and a Critical Review. One section of the Self-Assessment is a comments box in which students may discuss the problems they had or the opportunities they experienced in working through the modules.

I found that in these self-assessments students were more open about discussing themselves and their work. This was not an academic task for them, but a chance to discuss their particular learning experience with the module. As a result, some sources of information about their learning strategies were embedded in their discussions. The Self-Assessments resulted in 35 critical assessments of one to two paragraphs each.

Preparing Data for Analysis

The primary method for analyzing the data, given that it was all in text form, was necessarily focused on the words used or the ideas referred to, from that learning strategies could be derived or interpolated. There are a number of representative types of functions, that are considered indicative of learning strategies facilitating cognitive processing, e.g. sorting, outlining, graphing (Schunk, 1996). Since this list was developed mainly for children's learning strategies, and I found no comparable list for adults, I have added to the list from

my own experience as an adult learner, a teacher of adults, and a researcher. The following words are expressed in terms of functions, whether cognitive or physical, and include verbs such as:

- Searching - act of using search strategy to find information on the Web.
- Acquiring - act of printing pages from course site for future use or retrieving information sources from libraries, books, journals, etc.
- Accessing - act of using URL to call up web-page for course of source of information.
- Outlining - taking notes and putting them in outline form.
- Contextualizing - creating associative links with related knowledge and experience.
- Analyzing - synthesizing ideas from several similar or disparate sources and integrating them into a cohesive whole, that can be exposited.
- Gaining an Overview - attempting to organize information in such a way as to see the big picture .
- Selecting - determining sources most applicable and choosing from among them those that are most useful.
- Reflecting - meta-cognitive self-monitoring and interrelation of cognitive processes, skills, and strategies for resource acquisition.
- Writing - organizing thoughts, writing capstone projects, and including mechanics of good exposition.
- Organizing - Organizing thoughts or developing meaningful structures

- Note Taking - capturing information while reading in order to use later.
- Journaling - capturing thoughts and insights while in process of completing task.
- Creating - developing charts, pictures, or graphs that aid in explanation of some thought, cognitive activity, organizational structures, or series of actions.

NUMBER OF DOCUMENTS COLLECTED:

Questionnaire Responses	108
Follow-up Questions	24
Self-Assessments	51
Total	183

My initial examination of the data collected involved reading all of it, and underlining with a red pen those sentences or sentence fragments that used verbs suggesting some action or thought process such as those above. I began to categorize the detailed items by learning strategy type.

I began a third examination of the categories to see if I could discern patterns or themes in the students reponse regarding their learning strategies. What I discovered was that student responses were thematically arranged around the types of tasks they were doing for the Program. These were:

- ...to Navigate the Web
- ...to Complete the Capstone Projects
- ...to Participate in the electronic Discussion Forum

- ...to Connect with Other Students
- ...to Find and/or Access Resources
- ...to Communicate with the Instructor
- ...to Learn from or bring Meaning to their Practicum
- ...to Interact Meaningfully with their Mentor
- ...to Interact Meaningfully with Other Educator Professionals
- ...to Utilize Experience of Seminars

Again I returned to the task of reading the documents student by student in order to identify the detailed learning strategies that went with each category for each student. What I was looking for were patterns within patterns. For example, of the twelve students, how many read the study questions and the resources, then took time for reflection before writing the capstone, how many waited to begin in order to see what and how much other students had written, how many waited to see how much more information they could find before beginning to write, etc.

I began to realize that the way I had titled my categories did not suggest learning strategies but behaviors. The primary reason for this was that the list I had made combining Schunk's (1996) terms and my own, were actually expressed as verbs (actions), not nouns (things), and Learning Strategy is a noun. So, I re-examined the categories arriving at a list of nouns rather than verbs.

I began the examine the categories to determine a logical sequence for them based on the order a student was likely to use them, for example students' strategies affected by personal belief or schema are going to affect strategies in all categories,

but strategies relating to application of learning to navigating the web-site or accessing resources are going to be more narrowly focused and come within a process that contains several strategies. I put the strategies in order of breadth and or usage. I entered the re-ordered strategies into a matrix and assigned an alpha identifier to each one. A list of the learning strategy categories and their alpha identifiers follows.

- B - General Belief & Schema that Affected Strategies
- O - Overall Learning Strategy
- D - Impediments to Strategy Usage
- N - Web Navigation Strategies
- R - Resource Search & Access Strategies
- C - Organizing & Compartmentalizing Strategies
- W - Writing & Note Taking Strategies
- T - Thinking & Reflecting Strategies
- I - Interactions & Communication Strategies
- P - Practicum Application Strategies
- K - Broadening of Knowledge Strategies

Then I realized that by giving students numbers to assure their anonymity, I could no longer identify them individually. Not only had I de-contextualized their responses by attempting to code them for statistical reasons, I had eliminated their identity by assigning them numbers that even I could not recall relative to an

individual. I put their names back on their answers and their assessments and re-read the documents again.

I realized as I read their words that I saw their faces in my mind's eye, as I had seen them in their interviews and at the seminars. I heard their voices in my ear as I had heard them in their interviews, in their seminars, and on the telephone. I reflected on the issue of presence and the belief in the existence of a real human person even though you can't see them. I reflected on the issue of voice, that voice not only means writing in ones own unique way, but also in speaking in ones own unique way and being heard by another person. And I thought of all the students whose words I held in my hands.

When I sat down again to read all my students' papers, I was ready to really experience them, I could read their own unique expressions in words, I could recall their faces from my memory, and I could hear their voices in my ear. They were contextualized, identified, and present. I was finally ready to examine their Learning Strategies. The result of what I found in this examination is in the next section.

EXAMINATION OF STUDENT WORDS

The following examination and analysis of the PTE students' own words has been developed from their responses to the PTE Research Questionnaire (nine questions, 108 responses), Questionnaire Follow-up (5 questions, 24 responses), and Self-Assessments for each module Capstone (51 responses). Since the latter requirement was implemented at the beginning of Fall Term, self-assessments cover only Fall 1999 and Winter 2000 terms.

This examination incorporates all three documents, using the questions from the questionnaire as the cohesive mechanism to integrate responses that relate to questionnaire questions. The reason for this is that the questions on the questionnaire contained within them the issues that I was trying to seek clarification for.

I have embedded student quotes within this section, since that is the primary focus of my examination that is reading what students had to say in their own words about their learning strategies. However, as mentioned in the method section, I have re-sorted students out of alphabetical order, assigned a number to each student, and used that sequence in my statistical information. I have also used it in the appendices to relate responses to separate students. In the following examination of students' words, I have excerpts of students' words in quotes, and in italics. Following each direct quote is the students' number and a decimal followed by the source of the quote. For example, student number eight 's response to questionnaire question number 3 would be expressed as (8.Q3). Their response to

follow-up questions would be shown as (8.F1), and their response to self assessment for capstone number one would be shown as (8.A1).

There is a statement at the top of the questionnaire that the student's received as part of the questionnaire to inform them of the types and scope of learning strategies that are being examined by this study. This was necessary because some disciplines treat learning strategies as preceding cognitive processes, some treat them as part of cognitive processes, and some treat learning strategies, cognitive processes, and effects of environmental factors as all part of cognitive processes.

Following the questionnaire statement is each question which is shown in quotes as regular type, immediately followed by my examination and analysis of student responses in regular type to that question as taken from their responses directly to the questionnaire questions, from the follow-up questions, or from their self-assessments which includes their own words. When students actual words are used, they are shown in quotes, in italics followed by the student's number, and a letter identifying the type of document the student's quote was taken from; i.e. Q for questionnaire, A for Assessment, or F for followup. These alpha codes are followed by a number which represents the question number from the document which the student is responding to.

All of the questionnaire questions and responses follow in the same order. Brief comments and examination of apparent significance of student responses

follow each question. The complete questionnaire can be examined in the appendix without the responses.

Student Responses to PTE Questionnaire

The full questionnaire can be viewed in the Appendices (Appendix B) of this paper. In this section only the Questions will be repeated, followed by my examination and analysis interspersed with students actual words. Each of the student responses will be in quotes, in italics, followed by their number, Q for questionnaire, and the number of the question. This format follows throughout presentation of all the questions, examination and analysis, and responses.

Question #1-Expectations of Web Based Learning

"When you entered the PTE Program, what did you think learning on the Web was going to be like? How was it the same? Different?"

Only one of the twelve students participating in the study had ever taken a web-based course previously even though all are studying for licensure in Technology Education and/or Business Education, both fields in that computers are used far more than in Education at large, or in other types of jobs in the work-place. The student who had web-based training had received technical on-the-job training (operating systems and applications training), and works with computer networks and operating systems as part of his regular job.

Given the PTE students' disciplines for that they are seeking licensure, their lack of previous exposure to web-based instruction is somewhat surprising. However, if we consider the fact that web-based instruction at the university level, even in technical and professional disciplines, is just beginning to offer web courses as a regular part of their programs, it may not be so surprising. In most colleges and universities, students of all ages and all disciplines generally go to the university campus for classes, and the web, if used, is generally an adjunct to the traditional classroom form of instruction.

What the PTE students' lack of experience with web-based instruction also suggests to me is that industry has not used web-based instruction to any broad extent in training employees either. For one of the necessary requirements for students entering the PTE Program is 4000+ hours of work experience beyond entry-level in the subject content area for that students are seeking licensure in this case Business or Technology.

While one student has encountered web-based instruction as part of his work experience, he does not consider himself to have had web-based instruction in the same sense that the PTE Program provides it. It may be that the experience he had was with what is described is a Electronic Performance Support Systems (EPSS, or PSS). These types of systems are the outgrowth of the development of expert systems, resulting from the research in the 60's in AI (artificial intelligence). The purpose of these systems is generally 'enhancement' of performance, and may

or may not have included initial instruction on the system (Gery, 1997; Raybould, 1995).

Given the lack of experience with web-based instruction, it should not be surprising that there are varying expectations among the students regarding what a web course would be even for the one student who had some on the job training via the web,

"I have participated in many web-based training programs over the past few years. Most of my web-based training was technically oriented (Operating System and Application training). The PTE program is similar in pure web-based delivery, but was different in that there was no opportunity for on-line synchronous chat on a weekly basis" (2.Q1)

Normally this might raise the question of the variance of the PTE Program's format for instruction from other web-based courses used for instruction. One might want to know how much of the students' variance in expectation was due to their comparison and knowledge of traditional instruction vs. web instruction, and how much was due to their knowledge and comparison of one kind of web-based instruction as opposed to a different kind of web instruction. However, for the PTE students, with their overall lack of experience with web-based instruction, it is safe to assume that the variance in their expectation is due to lack of experience at all rather than due to varying experience.

The variance in student's expectation of what web-based instruction would be, compared to what they actually encountered seems also to express itself in variance in the strategies they used.

Only one student stated rather emphatically that they found web-based instruction to be what they expected, and this was not the student with the prior experience:

"When I entered the PTE Program, I thought that it would allow me the flexibility to schedule my own study and research time. In addition, I knew that my face-to-face discussions with classmates would be limited. I have to say that for the most part it is what I expected" (9.Q1).

Five students found the web-based instruction to be somewhat like their expectation, with variations. These variations included:

"Because I had worked some with EdNet, I thought it might be a computer based version of the talking head televised ed net courses" (12.Q1).

Another student stated that he really hadn't thought about it and expected that web-based instruction in the PTE Program would be as follows:

"I applied for the PTE months before viewing the Modules. I gave little thought to what the nature of Web-based learning was going to be like, but I assumed that it would be similar to a Web-based philosophy course that my son had already taken. He basically read assignments, engaged in on-line discussion, and wrote papers. No testing was involved in his course, and I didn't follow it close

enough to know the basis of his grade. I assumed grading would be traditional A-F letter grades on a 0-100 scale" (7.Q1).

Doing their own scheduling turned out to be something students hadn't expected. As one said:

"One thing that I have learned in the process of adjusting to this learning environment is that I must dictate my own deadlines" (9.Q1).

A fourth student's expectations were stated as follows:

"I thought that web-based learning would be independent (self-directed), on my time schedule, at my pace, and not dependent on other resources. I also hoped it would allow for more student-instructor contact than lecture-based courses. I have found it to be very self-directed, although I continue to be surprised by the expectation for me to read other students' comments" (4.Q1).

The fifth student worried about the rigor of instruction in such an environment:

"I really didn't know what to expect from learning on the web. I was afraid the learning would be elementary and not involve the critical thinking that has occurred" (5.Q1).

Four students stated that they had no idea what a web-based course would be like. One stated that he was clueless :

"I truly had no clue what web-based learning would be like or how I would go about it (10.Q), or as stated by another student: *I anticipated using browsers to locate specific subjects of study and writing a report on subject area"* (6.Q1).

A third student said:

"I thought that learning on the web would be to go to a web page and download an assignment, do some work, turn it in and get a grade" (1.Q1).

Student thoughts ranged from relying on their prior success in other programs, *"I have been successful at other programs and felt that this would be no different"* (10.Q1), to focusing on convenience, *"I thought that learning on the Web would be convenient"* (11.Q1), rather than the unknown nature of the experience.

Generally students expected more of a traditional classroom format, only web-delivered, *"Something similar to traditional lecture classes where reading and research are assigned with either an assessment test or written document using APA, MLA, etc"* (6.Q1) or *" I pictured our program to have a series of lectures on text-one for each day-simulating the traditional classroom. I suspect a lot of Web based courses are formatted that way"* (3.Q1). However, students are not alone in their belief that web-based instruction is merely a different delivery method for traditional classroom teaching.

Several other issues come to mind in reading students words about their expectations regarding web-based instruction. Did students' expectations affect the strategies they used? In examining the strategies that students used it appears that they were selected not necessarily in the belief that learning strategies from the traditional classroom are just as good for the new environment as for the old one, but that there aren't any new strategies that have been identified as better for the new environment. So we (both students and teachers) are using what we have.

Other questions that come to mind are, did the students who got what they expected have more of an overall meaningful learning experience than those who didn't? Did students who expected one thing and got something different have more difficulty adjusting their strategies to the difference than the students who expected nothing? Did the variance in expectation and reality cause students to have unrealistic and possibly conflicting expectations about what web-based instruction should be? Were they even aware of the unrealistic and possibly conflicting nature of the expectations they discussed?

The first major issue for me as their instructor is that I didn't know that none of my students had prior experience with web-based instruction, nor that their expectations of what the experience would be like was so far from the actual experience. Upon entry into the program they were interviewed and asked about their experience with computers. All were in Business or Technical work areas, and all had computers at home. All had e-mail addresses and used word processing. I had made a false assumption that there would not be a traumatic adjustment period as there had been in other web-based classes I had taught where students came from disciplines totally dissimilar to anything we experience in business or technology. I had not accounted for the trauma of adjustment and the effect of miss-belief as I had in my other classes. I didn't think to ask, and the students may have felt that the instructor already knows and this is just part of the program of learning .

However, I know from my own experience that even though I had years of experience teaching people to use computers, going from teaching adults in

industry to teaching adults in a classroom to teaching adults in a lab to teaching adults in a web-based program, that the transitions to these various environments for teaching and learning take time and effort, particularly from a traditional classroom environment to a web-based environment. The adjustments are complex, they are not obvious and it takes courage and commitment to choose this form of instruction and negotiate it successfully, either as a student or a teacher. Knowing from their own words what the PTE students faced and overcame rather silently, has been a humbling experience for me as a teacher.

The self-discipline and self-direction necessary for success in a web-based program such as PTE, took everyone by surprise. One student who expressed it really well said, *"The very first task (after browsing Module 1) was to try and figure out what I had gotten myself into and if I could adapt my learning style to the PTE format. I had to completely re-think my learning skills"* (3.Q2). He also spoke about *"Coming into the PTE program I had not before experienced an inquiry-based class"* (3.Q1). Another spoke of *"Going into the early modules I also felt a sense of solitude that is unlike the conventional classroom environment. You tend to feel somewhat isolated, like you have no peers to interact with"* (11.Q1).

The sense of isolation mentioned by the student above and the difference in communication with the instructor and the other students are not only tremendous adjustments, they are revisions in schema regarding what constitutes communication. One student had already heard some descriptions from colleagues that gave her a sense of what learning on the web might be: *"I attended some*

professional seminars on distance learning and one issue of concern was how to know if people who are supposed to be on line at a certain time are really there. They were talking about ways to be sure the person was still sitting in front of their computer rather than out grabbing a cold one in the other room, or being out all together. I remember thinking this was a bizarre issue and kind of ironic, given the inherent and forced independence of distance learners. So, I had this vague preconceived notion of having to meet up online with the class" (12.Q1).

It appears that all were adjusting to the loss of the traditional classroom environment where the teacher and other students were always present, questions could be asked and answered all at once, there were syllabi with time schedules, course content was linear, and there were pre-constructed assignments. While many students object to the rigid structure of the traditional classroom, they are not prepared for the apparent freedom of web-based learning.

The student also discussed the idea of being independent, *"differences from my preconceptions are: Being responsible for devising my own time schedule, Not having a particular class time, Self assessing my work, Posting work, The Discussion Forum concept and practice, The inquiry based learning model, Not having to purchase textbooks, Not reading, memorizing, being lectured to, or taking tests, The freedom to determine the sequence in that modules are taken"* (12.Q1).

Within the students' discussion of what they thought a web-based environment would be were several conflicting or paradoxical conceptions

suggesting a dissonance (Festinger, 1957) between desire and reality, a separation between the basic nature of classroom instruction (good and bad) and the realities of web-based instruction (good and bad). What this reinforced for me is my belief that those of us who are pushing forward into the application of technology to the delivery of instruction whether we are teachers or students, are all presently caught in a time-warp or what John Naisbitt calls "a time of the parenthesis", the time between eras that is a time of change and questioning (Naisbitt, 1982). Several of the dissonant desires and expectations on the part of the students relative to web-based instruction were:

- the desire for convenience of setting own schedule against the reality of being on one's own as far as scheduling tasks and disciplining oneself to do them on time.
- the desire for convenience to work on class assignments when personal schedule dictates, yet wanting teacher office hours for more one-on-one that is convenient for students who are all working on different schedules.
- the desire for ability to work from home on own schedule pitted against the desire to have face-to-face interaction with other students in a fixed place, students who are also themselves all on different schedules.

Question #2-Learning Strategies and Course Content

"What was the first learning strategy you used? Why did you choose that one? Was there any relationship between your learning strategy and the course content?"

The responses to this question concerned what the program, and the modules expected of the students. Also interestingly enough, only one student spoke in terms of what the instructors expected. This to me is a significant difference from a traditional classroom perspective where the instructor's expectations often take precedence over the course expectations and the two are often not viewed separately .

Students dealt with their need to know what the program and course expectations were in different ways, using different learning strategies. The students seemed to be almost evenly split between those who began with a what they described as primarily a cognitive strategy, and those who began with what they described as primarily a behavioral strategy. At this point I will not attempt to discuss the subtle overlap between behavior and cognition, but will suffice at the moment to go with the students' interpretation of that type of strategy they were using.

In a more common vernacular we would say that the difference between the student's strategies for determining the program expectations was to begin by 'getting the lay of the land' by looking at and reflecting on the major focal points of the program and to begin by doing something and then interpreting the results in order to relate it to program expectations.

A statement, that bears repeating was made by one students who addressed the meta-cognitive issue of strategy and learning style. He said, *"My first learning strategy was cognitive. The very first task (after browsing Module 1) was to try and*

figure out what I had gotten myself into and if I could adapt my learning style to the PTE format. I had to completely re-think my learning skills" (3.Q2).

This was basically the only student, according to their own words, who began by thinking in terms of learning style, strategy usage, and the possibility that there might need to be a change made to accommodate this environment. Thinking about doing something differently is at a more meta-cognitive level than doing something differently for it incorporates planning, organization, and execution. Not that the students who used different words weren't also processing at a meta-cognitive level, it may be that they just didn't express it that way.

Another student's strategy was, *"I used my normal strategy (and the strategy recommended by PTE) ... first, take a good look around the site, then explore all the links, and try the first module to see how well my results match my expectations"* (3.Q2). I think it's safe to assume that for this student that taking a look around constituted constructing his own overview and the beginning of an overall strategy for how to satisfy the expectations of the courses.

There were four other students who spoke in terms of organizing themselves and their work. One phrased it as, *"The first learning strategy I used when I began the program was action. I spent a lot of time trying to organize the requirements of the program, printing many pages from the web and creating a large resource notebook. I chose this strategy in an effort to completely understand what was expected of me"* (9.Q2).

A second student expressed their organizing strategies in more specific terms, such as, *"I read the requirements, numbered the tasks, printed out the resources, read and highlighted them, and completed them according to the task number. Then, I tried to boil the capstone instructions down to their essence and completed the capstone according to my interpretation of the instructions. Some of the tasks and modules required more reflection on my practicum experiences than others, while some required a different writing style (narrative vs. expository). Some tasks also required that I research, find, read, and evaluate outside sources, this need took me to the OSU library, OSU bookstore, the ESD curriculum library, the www, and other places"* (4.Q2).

It seems apparent that this student was developing a very thorough overall gameplan for completing the module capstones and the requirements for the program, that being a learning strategy in itself.

A third student spoke of his organizing strategies as, "*Behavioral oriented. I did a lot of busy work (making a notebook with all the information from the web-site and making up files. Action orientated. I spent more time organizing my time than doing the actual work. I think that is the type of person I am. I am well organized and plan things well but the actual doing of the work is sometimes difficult to get motivated for"* (1.Q2).

Interestingly enough here the student mentioned that he spent more time organizing himself than he did actually doing the task that he found hard to become motivated for. From his words one gets the impression that he thought the doing

of the task should have more value than the organizing of the task even though it was the organizing of the task that he enjoyed more. In any educational environment the doing of the task is required in order to get a grade. However, the skill of organizing the task is of value and important at a different level. When one is in an academic environment, it's the completion of the task not the planning of it that gets the attention. In a business or technology environment the organizational task would be just as important or in some cases more important because the organization of the gameplan for completion of a task the overall project and in some cases the structure of the finished product.

The fourth student who spoke in terms of his organizing strategy referred to it as behavioral, "*The first learning strategy I used would be behavioral. I am very structured and organized when learning. Writing things down and taking notes were the first steps for me. In relation to course content, I spent more time with behavioral strategies when the task was complex or confusing. With relatively simple tasks, I would use more of a cognitive strategy*" (11.Q2).

Three students described their approach to their work and learning as very organized, behavioral, and linear. One said, *"I would begin each module independent of the others and work on it from start to finish and then begin another module"*(5.Q2).

It is interesting to note that these students saw being organized and linear as behavioral rather than necessary for other reasons. For it is possible to be organized and linear without being behavioral. It would also be interesting to examine

whether student strategies were truly behavioral or whether they just thought of them as behavioral. For even cognitive tasks have behavioral components, and vice versa. It's where we differentiate between the two that determines where one ends and the other begins. This is especially true in subject content areas where usage of equipment is a major part of the overall task, that is the case for students in the PTE program. One cannot deny that a major attribute of such students is achievement of a skill that is behavioral in anyone's lexicon. However, a major part of determining differentiation comes from one's disciplinary perspective, psychology, education and information processing?

Three students may have spent considerable time organizing themselves beforehand but they didn't express it that way. Rather they basically did what one student describes as dive in. One student stated that he would, *"try the first module to see how well my results match my expectations"* (2.Q2).

All students referred to an overall learning strategy that I see as a process of strategies. One student expressed it as, *"In all of the Web-based modules, I have first read the syllabus to learn the content of the course and the capstone expectations. I then gathered research from sources including the Web, periodicals, materials from my practicum site and other sources as needed. I spent time observing the classroom environment and students in my practicum and speaking to other educators. Then I approached the assigned capstone. I think the process incorporated all of the tasks I have mentioned"* (8.Q2).

Five students spoke of printing out the pages and creating a notebook.

There were several reasons given for relying on this strategy. One student included this as part of her organizing strategy, *"I spent a lot of time trying to organize the requirements of the program, printing many pages from the web and creating a large resource notebook. I chose this strategy in an effort to completely understand what was expected of me"* (9.Q2). Two others referred to this strategy as, *"reading the requirements, numbering the tasks, printing out the resources, reading and highlighting them, and completing them according to the task number"* (4.Q2). The other said,"*Writing things down and taking notes were the first steps for me*" (11.Q2).

A fourth student chose to print out all the pages after trying unsuccessfully to spend the length of time required to read them on the Web, that was too difficult because of a visual problem. He spoke of his strategy, *"As a new member of the paperless society, it was my idea to download everything from a module and read it on the screen. This did not work for two reasons, I cannot look at a computer monitor that long without getting eye strain and I need more contact with the material. Now when I start a module, I go through the web site and send everything to the printer"* (10.Q2). The last student who used this strategy included the following reason, *"I am well organized and plan things well"* (1.Q2).

Overall the types of strategies used combined all three types of strategies described the top of the questionnaire, cognitive or thinking about it, behavioral or doing something, and action or go make it ready were:

- Printing out the pages (5 students)

- Making a notebook or resource book (3 students)
- Scheduling time (2 students)
- Making notes (2 student)

Generally student strategies were non-competitive and self-directed (Candy, 1991) calling upon a student's achieving their personal best unrelated to other students in the program. However, one student's initial strategy while not competitive identified himself as someone who started out wanting to do no better and no worse than the rest of the group. He expressed it as, *"My first learning strategy was to stay with the herd. I'm not sure if this is really a learning strategy, or just a survival strategy. Staying with the herd in this case means to roughly equal the amount of work done by my fellow students. I didn't want to establish a precedent of submitting work that was more than required, but I also didn't want to submit substandard work"*(7.Q2).

This was a strategy of getting the feel of the group effort more than a feel of the course and program requirements and the student even questioned that maybe this was a survival strategy or safety in numbers. As an educator we can understand this strategy while at the same time recognizing the artificial limitations this places on student performance. However, to this student's credit he stated that he abandoned this strategy after the first term.

Several significant considerations emerged from the responses to this question. The first is that most students have a number of related strategies that I would call a learning strategy process of learning strategies that they used in

varying degrees to complete the varied activities required for the tasks in the program. The other consideration that emerged was that some students used their learning strategy process in a very linear way, and one at least used it in an iterative or recursive way. An examination of the effectiveness of the difference in usage would be an interesting study in itself.

Question #3-Strategy Changes

"What were your subsequent learning strategies? Were they related to the first one? If so, how? Were they related to different course content?"

Question #1 attempted to address the issue of variance in expectations by students of what the course would be like, and Question #2 examined the students' beginning strategies that got them into the course and its content. Question #3 deals with the next phase of their strategy usage now that they have some experience in the web site, have had some experience in their practicum sites, and also had some experience completing the capstones for the courses. I was curious about whether or not the strategies that they began with had changed or were beginning to change, or they had developed any new strategies as a result of interaction with the course content and the web site. A questions behind the question that I was attempting to ask was what affect did having to perform so many tasks independently, synthesize them all, and write a capstone have on their learning strategies. I was also curious whether the activity had caused any new or different strategies to emerge.

At this point it seems appropriate to explain how I have defined what new strategies and different strategies and existing strategies mean in the context of this study.

- New strategy is being defined as new for this student, , never used before in their learning even if they knew about it or someone else knew about it.
- Different strategy is being defined as different for this task, requirement, etc. In other words, this strategy was used before but it has been transformed in some way in order to be used for this task.
- Existing strategy means a strategy that the student has used before whether in a different context or not, but is now using the same strategy the same way in this context.

One student stated that, *"My strategies are pretty well described [in response to question #2]: reading, reflecting, writing, revising"* (4.Q3). Two students said that their learning strategies were upgrades to the ones they started with. One student described what these were now: *"Subsequent strategies, relation to first one: My subsequent strategies were upgrades to the first one. I have landed on a strategy that works well for me, no matter what the course content is of the module. My steps:*

a) At beginning of term, choose that module to start with

- *Print out and read all material (syllabus, tasks, list of resources, etc) for all modules to be completed*

- *Decide where to start based on what's happening in my practicum and where I think my biggest and most pressing knowledge gaps are;*

b) *Force myself to start, be sure I understand capstone task,*

c) *Re read the hard copies of module info previously printed, taking notes in margins, order books from Valley Library;*

d) *Print any task resources that are feasible to print, so that I can read them in my rocking chair and take notes on them;*

e) *Read online any others;*

f) *Keep going back to tasks and capstone, I find that after going through the resources I have some ah-ha's regarding the nature of the capstone (oh so that's where this is going....);*

g) *Do focus questions and review/take notes/reflect on course objective;*

h) *Gather it all together and write capstone. Once I start writing the capstone I give myself a completion deadline for submission, usually about a week after I start writing. The research/note taking/reflection/is what takes the bulk of the time when I'm working on a module;*

i) *Refer to dictionary frequently, even for well known words, to get a precise and new perspective"* (12.Q3).

The above students strategies are most representative of what I might call a mega-strategy, a learning strategy process of learning strategies. One of the characteristics of the process that the student above describes that is especially effective is that the strategies within the process are used in an iterative way.

For the type of learning that is required in the PTE program, inquiry-based, and for the varying types of information that needs to be synthesized, research, practicum, modules, capstones, discussions, etc., an iterative approach seems to be the most effective. This process allows the student to cycle through all the steps returning when appropriate or required to an earlier step while still retaining an internal continuity. I believe that for this student the maintenance of continuity is facilitated by her meta-cognitive approach to solving the problem of completing the module capstones that includes gathering, synthesizing, reflecting, and writing.

One student talked about spending, *"a lot of time with the cognitive strategy and then, I forced myself out of the cognitive, I moved to the behavioral to create an outline"* (9.Q3). I'm not sure that making an outline is a behavioral strategy. There seems to be confusion throughout the responses regarding what constitutes behavioral and what constitutes cognitive and I may have contributed to the confusion with my definitions at the beginning of the questionnaire. Therefore, I sent a follow-up question to the research participants asking them to describe for me what they meant when they said behavioral and what they meant when they said cognitive. The responses from the follow-up questions will be discussed at the end of this section.

The second student of the two who considered that they upgraded their strategies from their initial ones answered question #2 by saying that he had initially *"used low-level cognitive learning simply because it had worked in the past and met the requirements of assessment. Call it testing the waters since the*

assessment team was an unknown" (6.Q2). This student answered the third question regarding strategies being used now as an upgrade, *"I used higher-level objectives and affective learning along with performance objectives. Yes, but more enhanced. The lessons challenge the student to reflect and assess his teaching environment and integrate these reflections with resource learning. The assessment questions asked in the virtual exercises focus on resource learning: What do I want to know? What resources will I use? How will I organize it? How will I evaluate it? What did I find out?"* (6.Q3). What is interesting about this student's statement is that it suggests that students may have several groupings of horizontal and linear strategies as part of a process, and that they may also have a series of vertically arranged strategies of increasing complexity. One questions if these increasingly complex strategies are called upon for performing the same basic or similar function as the low-level strategies but more intelligently? Faster?

Or more complex strategies may be reserved for more complex cognitive processes that the student seems to suggest. The manner in that the student consciously makes a decision regarding that level to use and determining what types of things they are useful for is also interesting. This brings the issue of learning strategies into a meta-cognitive realm rather than approaching it from the perspective of something someone just does without thinking about it, that is the way that several student referred to them.

Three students stated that their learning strategies at this point had no relationship to their first strategy, one stated: *"I spent a lot of time with the*

cognitive strategy... Once I forced myself out of the cognitive, I moved to the behavioral" 9.Q3). Another student stated that he had *"abandoned the 'stay with the herd' strategy"* but still found it challenging to determine what order and when to use the strategies of reading source material, reading other student's submission, reflecting, writing, and stated that while he used all of these, he didn't use them in *"any organized or consciously systematic way and was not consistent in applying the practice"* (7.Q3). The last student who stated there was no relation between first and subsequent strategies stated most emphatically that *"strategies have had to change!"* (10.3). This student came out of engineering whose content is extremely structured and attributed this change in strategies to the fact that *"teaching is an art! Therefore, the material about teaching is more fluid"* (10.3)

One strategy that appeared to be consistently used was the process of allowing for reflection time between reading and writing. One student described it as follows: *"I prefer to read the assignment and the related material days before writing my response to the assignment. Sometimes, if they were available, I would read other student's submissions. During the few days between my reading and writing, I would often notice events that would influence my writing. I would also mull over what I would write, and how I would say it....basically [I] give my response time to develop before it goes on paper (or the CRT)....in some instances I felt that I was ready to write sooner if I had already had inspirational experiences on that to base my writing"* (7.Q3). Since the module capstones are inquiry-based this seems to be an appropriate strategy. Also, given the varying quantities and

types of information that students need to synthesize in order to complete their capstones, it seems appropriate for students to consciously allow time for this strategy. One student phrased it as, *"I finally forced myself to use cognitive learning to actually synthesize the information and my classroom experiences. I think that when I finally did start that process, I was able to use the other learning strategies I noted in Question #2"* (1.Q3). One student had a unique strategy, that also appears to be iterative, that she described as, *"To study each module as thoroughly as I wanted to, I found it necessary to allow myself extra time. Therefore I would essentially begin several modules all at the same time in regards to obtaining and studying research materials. In addition, some modules because of their relationship to each other allowed me to consider other questions"* (5.Q3).

When asked whether their strategies related to the course content, two students said "yes", with one discussing how the subject matter (teaching) was different from the field he came from, and the other student saying that the relationship among the modules subject matter and capstones made the strategies related to the content. Four students said "no" to this question, with one student clarifying their statement by saying that, *"the course content and my strategy do not seem to be related. Rather, my learning process seems to be related to the program structure and my learning style"* (9.Q3).

Interestingly enough, this last student was the only one of the twelve who referred in response to this section, that the method of program delivery might have had any effect upon their learning and learning strategies. However, it is uncertain

if she was referring to the program structure as the modules and their content, or the program structure as the delivery method. None of the students in responding to this question appeared to challenge web-based delivery of the program directly in discussing their learning strategies and the efficacy of them.

There are a number of underlying issues surrounding learning in a web-delivered program and all that implies on a human level, cognitive capability, strategy, skill utilization, schema, prior knowledge, memory, uncertainty, risk, individual psychological, physiological and educational anomalies etc. and all that implies on a technological/machine level, reliability, availability, time, interaction, consistency, accessibility, etc. This lack of recognition and reference to the program delivery method is remarkable in itself and worthy of examination at another time.

Question #4-Strategies and Program Structure

"How did the content of the modules and the structure of the web-site align with your learning strategies? What features would you change? Keep? Add?"

Two of the students felt that the module content and structure of web-site aligned with their learning strategies, one said, *"for the most part* (9.Q4), and the other said they were *comfortable with the alignment*" (4.Q4)

One student said that the content of the modules had little to do with, *"allowing mental development time"* (7.Q4), that this student referred to as a new strategy and that he would use in other subject areas. I interpreted this to mean

that being required to do extensive reflection and synthesizing of a variety of information and experiences, and then expressing one's own opinion was a new learning environment for this student.

Three students stated that the module content did affect their learning strategies, one said that they, *"drove my learning strategies and thus were perfectly aligned for their purposes"* (12.Q4). Another said that content *"aligned my strategies with course work, made resource and curriculum learning very easy....and the learning architecture as presented is excellent*" (6.Q4). The last student said that lack of a clear-cut plan was disconcerting at first but, *"as [I] began to work through the modules, I began to have more appreciation for them "* (1.Q4).

Difficulties that students cited with the module content were:

- capstones were often too obtuse for ...comprehension,
- discussion forum was frustrating because there were too many things to sift through,
- modules need a vocabulary list or glossary,
- subject matter of task assignments were often too basic,
- change or drop the name capstone, since there's only one and the word capstone implies the best of many,
- add back the three tasks for credit because it allows students to work up to capstone,
- keep the focus questions as questions only without credit,
- have instructors more involved in discussion, moderating it,

- more difficult because it requires more physical effort with the material than traditional classroom learning,
- doing an outline was a new strategy in order to write capstone,
- focus questions were sometimes vague and confusing,
- wants the calendar on each module returned,
- more time spent researching online than for regular classes,
- did not see a favorable progression in the flow of the modules,
- not a good alignment between experiences in practicum and modules, Those things that most students really liked and would keep are:flexibility of setting their own time schedules,
- ability to select that module they want to take and when,
- the inherent inquiry-based structure of the modules.

There was really only one comment that several students made that directly addressed the delivery method, web-based. That comment was:

- add an on-line chat room,

One student who initially had no idea what to expect in this program stated it in his response to question #2 as, *"[My] very first task was to try and figure out what I had gotten myself into and if I could adapt my learning style to the PTE format. I had to completely re-think my learning skills"* (3Q2). Looking back over his prior educational experiences before coming into the PTE program, he reflected on the fact that his prior experiences had left him with a lot of strategies to overcome, *"There was a lot of 'garbage' in the way for me as a learner....all of my*

formal education [had been] buried in the philosophy that placed more emphasis on the rules of learning, than the learning itself, work must be turned in on a certain rigid schedule or it doesn't count, there being more value placed on the fact that when being tested you do not cheat, rather than the knowledge you can communicate" (3.Q4).

Another statement about changes in students' perspective regarding web-based instruction was made by one student who said, *"I changed my expectations based on the structure of the [PTE] web-site"* (2.Q4)

I think it's obvious when examining the answers in this section that each person has their own set of unique learning strategies, and learning styles, and for the elements in the program that some like, others do not. For the elements that some students want to be added to the program, some want similar elements taken away. However, in my conclusions I will discuss what appears to be some underlying basics that students want from this type of web-based program, and how these might relate to individual learning strategies and learning styles.

Question #5-Communication and Discussion Forum

"Describe your beliefs about communication. Relate your beliefs to web-based instruction. Discuss the learning strategies you used for the electronic discussion forum, task and capstone submission, and e-mail. That ones worked and the ones did not."

The purpose of this question was to try to find out student beliefs of about communication, and how these beliefs may affect their strategies for communicating in the asynchronous discussion forum. This is important because such an environment involves communicating through a written medium, without face-to-face contact, written words, and the discussion forum is the most effective device that the program had for students to build a sense of community with each other.

Most people believe that effective communication necessarily involves face-to-face interaction, a belief that is strongly held by both teachers and students. In a web-based instructional environment, the belief that face-to-face interaction is a necessary condition for communication is being tested. In response to this question, one PTE student cited the dictionary definition of communication that is, *"to communicate is to convey information "* (7.Q5).

In responding to question #5 about communication, students gave longer and more specific answers than they gave to most other questions. This obviously was an important topic for most of them. One student stated that, *"I feel that communication occurs best when all of the parties involved have a general understanding of each other. In addition, some issues require face-to-face communication"* (9.Q5). Preferring face-to-face, this student compartmentalized her communication strategies by trying to achieve, *"a balance between issues to discuss face-to-face with my mentor and those I chose to post to the forum. I have found that I try to post my reflections to the discussion forum that directly related*

to the module I am working on. Other issues, I discuss using a face-to-face situation. I would keep the forum, but wouldn't expect much discussion. My preferred discussion occurs face-to-face so I find myself discussing issues at length with my mentor teacher and other education professionals. I have used e-mail sparingly and most often with the program supervisors" (9.Q5).

Another student stated that *"With humans, we have our five senses to work with. Sight is probably most important, but sight communication is not all equal. Both the viewing of printed text and the viewing of events are clearly means of communication, but each has its advantages. Communicating with all senses (being there) is undoubtedly the most effective communications method, but that doesn't mean that it's best for all types of learning. As our texts and other resources point out, our minds need to build schema, and this benefits from communications via text and discussion as well as first-hand experience* (7.Q5). He goes on to point out that, "*NO method of instruction is all-inclusive*". His strategy for usage of the discussion forum is only to participate and submit when he has something specific to provide, and to only take from it when there is something that is useful to him specifically.

A third student's observation is that, *"web-based instruction can provide an appropriate level and type of communication for mature students but would be inappropriate for most young or associate-level students"* (4.Q5). This student also talks about their feeling that," *e-mail, capstone submission, and self-evaluation feel most action-oriented"* (4.Q5). This is intriguing to me as an instructor because these

tasks feel very cognitive to me as I sit and read student's submissions, think about my evaluation, and proceed to key them in without ever leaving my chair. However, this student appears to discuss a reward strategy that she used to get herself to perform the necessary communication via the discussion forum when she states that she,*"enjoys these most because I know that another module is done, and that I will get feedback"* (4.Q5). This is also interesting to me as a web-based instructor because the inclusion of the reward as part of the strategy not only makes it decidedly behavioral but also suggests that it is difficult to motivate oneself to perform this task, an unpleasant task, without a reward at the end.

A fourth student states that, *"communication should be clear, honest, and succinct with excess verbage excluded"* (12.Q5). This student states that, *"My learning strategy for participating in the discussion forum is still evolving. I have a hard time keeping up with it because for some reason my options and identity are at random. Now I know that if I don't get any emails indicating action on the forum, I need to go in and check those settings. Usually I find that it thinks I'm someone else, and my subscriptions have been blown out. After accommodating for that, what I do is print out submissions that I want to respond to. I reread them, jot a few notes, then go back online and post a response. I find I keep up best if I read, print, think about them, and take notes at night, then spend about 15-20 minutes the next morning posting responses. Something that doesn't work is letting too much time pass. You have to respond within 24 hours or we've moved on to something else. So not responding quickly was a strategy that did not work"* (12.Q5).

This same student also states that, *"I have over 1300 emails (from everyone, not just the PTE program) in my personal mailbox so I'm not doing a very effective job in email area"* (12.Q5). This suggests to me that accessing and reading e-mail is not a favored task or method of communication for this student. She mentions that she looks for responses to her discussion in her e-mail that may suggest that she doesn't go regularly to the forum just to browse and read. Once again it appears that another student is treating participation in the discussion forum as an unpleasant and unwelcome necessity.

A fifth student states that, *"communication works best when it is real time between two or more people in a safe comfortable environment"* (10.5). This student goes on to state that, *"web-based education is not just a fad, ...and is here to stay"* A certain degree of reservation about the desirability and effectiveness of the process sounds embedded in this statement.

A sixth student states that, *"I am biased in that I have taught communication at the collegiate level, have taken training classes in communication, etc. I use the traditional model of sender, encoding, message, decoding, receiver, and feedback. We think of communication a being verbal and non-verbal. However, in industry at least 50 percent of my communication was the writing process. The other 50 percent were divided between meeting, phone, and team activities. In fact all of the psychomotor educational objectives are present"* (6.Q5). This student sees a major disadvantage in the forum because it is slower than verbal communication and lacks the non-verbal cues of face-to-face.

However, one might bring up the issue that an asynchronous discussion forum is meant to be slower. It is not designed for rapid communication. It is designed for pondering and reflection and for constructed and developed answers to be shared. This misunderstanding of the usage of an asynchronous discussion forum could well stem from students lack of knowledge and understanding regarding expectations within web-delivered instruction. The issue of better information regarding expectations to incoming students will be discussed in the last chapter; suppositions, conjectures, and reflections.

Several students asked for a chat room, that would be more appropriate for rapid discussion. However, this form of communication brings up issues of cognitive overload and difficulties in visual processing. Having experience within other web-based classes that I've taught, I suspect that there are issues there of visual processing and cognitive overload.

A seventh student expresses reservations about *"the pervasive nature of electronic communication"*, and that, *"it is kind of scary to think about all the people who are feeling squeezed about needing to learn more about it just to keep up"* (1.Q1). Part of the scariness here might also be the uncertainty about one's learning skills (as one student stated previously) and whether or not *"re-thinking"* ones learning skills is a task most students even want to undertake.

The eighth student talks about the issue that *"web-based instruction forces you to develop your written communication skills"*. He goes on to state, with a great deal of insight that *"if your other communication skills are less than what they*

should be, one can still be judged bright, but there is no room for inventiveness in written communication" (3.Q5). One could say here that there is a lot of inventiveness in creative writing but I believe that what this student is referring to is expressing one's ideas on an important academic or intellectual subject in such a way that it is found acceptable by those who are evaluating it, and ultimately the student who wrote it .

The ninth student states that, *"I do not believe that everyone communicates in the same manner"* (8.Q5). She goes on to discuss the differences in personality that she believes affect the desired form of communication, more extroverted people naturally prefer a more traditional environment that face-to-face interaction. This student also states that she approaches the discussion forum in the same way she approaches discussion in the classroom as a listener. It's interesting that this student in describing herself does not appear to be extroverted, but yet she prefers a face-to-face environment. Not to be considered a value judgement on this students behavior, but an observation that there is more diversity that we generally accommodate, and this seeming paradox is understandable if we knew or understood this student well enough.

The tenth student discusses the forum in terms of the participants and rightly observes that as the students have changed, the nature of the discussion has changed, that seems to be an observation on her part rather than a negative statement. Also, she turns out to be the only student who has said something positive about the forum: *"I enjoyed getting feedback from fellow students*

concerning different issues and learning how schools work in their neck-of-the-woods" (5.Q5).

The eleventh student likes the discussion forum, *"for its historical significance"* (2.Q5), that he found helpful in the early days of his participation in the program because the various forums contained all work that students had submitted and is helpful to a new students attempting to get a feel for the requirements for completion of the program capstones. As a teacher, I feel that having all students work available for other students to read is an enormously beneficial learning strategy for students, and I have yet to find one student who plagiarized another's work, even though I know from what students have said, they gain inspiration from each other. In fact I have encouraged them to cite each other's work in their own if they wish, not to the exclusion of regular citations of course.

The final student, the twelfth, was the most negative about the forum stating that his *"learning strategy for the forum was to gain new ideas or resources from his peers"* but often, *"found it to be a soap box"* and to be a, "*hassle*" (11.Q5).

As you can see, only two of the twelve students had anything positive to say about the discussion forum. Several suggested that a chat room might be good but having run a chat room as well as an asynchronous discussion forum I suspect from experience that there are serious issues about both forms of web-based communication and that there are students who dislike each or both as well.

I think an additional issue here relative to web-based communication is the apparent dissonance between the instructor's beliefs that a discussion forum or a

chat room is what students want and need to build a sense of community, and what the students actually want and need, or think they want and need. It is quite possible that there is nothing that would please everyone, or even most participants.

One could conjecture that chat rooms appears to be the most popular means of communication on the Internet. However, several major differences between those and the ones in a web-based program are that participation as part of a program is usually required not optional and all the students know that somewhere the instructors are lurking even if they're not overtly participating. The students in the PTE program who seriously wanted to build a sense of community with other students established other ways outside the program to develop this, as they've told me. Maybe as web-based instructors we are trying too hard to overcome what we also may believe is a disadvantage to students not having face-to-face contact with each other and the instructor. Also, maybe we also begin to questions our beliefs about communication or a sense of community and whether it can be built without the face-to-face interaction. I would suggest that people have been developing a sense of community with each other for centuries without the face-to-face. They used letters that is also a form of asynchronous communication.

Question #6-Tailor-Made Instruction

"If you could have the very best form of instruction tailor-made to your own learning style and strategies, what would it be?"

As a teacher and researcher in web-based instruction, I was hoping this question would lead to a ringing endorsement of web-based instruction for its convenience, for its availability at any hour, for its abundance of resources, and for the one-on-one interaction with the instructor with rapid response. I was wrong.

Mostly what came out of the responses to this question were wishes for very personalized, yet still traditional forms of educational instruction and interaction. I would say that the primary wish of every student was to learn what they please, how they please, when they please, with their very own dedicated teacher. If the theories of J.S.Bruner (1977) and L.Vygotsky (1930) are to be believed, this is not only the most effective way to learn, it is the most desired way to learn. Following are several students' comments about their desired tailor-made instructional system and one can see that embedded in these are students favored learning strategies.

"The web program is very close to a program tailor-made for me. I especially enjoy the opportunity to learn-by-doing offered by the practicum component. The very best form of instruction for me would be an apprenticeship program. As an adult, the most intense learning has been gained on-the-job" (9.Q6).

"When I am to learn new material, I like to have an overview first, that helps me to see the point of the instruction in advance. An overview helps me to set a goal. In this sense, goal does not need to be specific – only a direction" (7.Q6).

"It is pointless, and possibly demeaning, to start with a student on too basic a level. Likewise, it is equally pointless to require in the short term for a student to perform too far beyond his current abilities" (7.Q6).

"I know from industry experience that there is benefit from exposure to multiple environments. I worked for three companies and five consulting firms. They all did things in different ways, that improved my knowledge of the industries" (7.Q6).

"I would have the opportunity to learn/do something with guidance, reflect on it with someone in the know, practice it a couple more times, evaluate myself, be evaluated, and do it on my own-with on-going, periodic evaluations and diminishing guidance/support" (4.Q6).

"The PTE program is it" (12.Q6).

"My best learning experience was a small class of 10 to 12 students that covered very technical material. There were also labs in that we used instruments to layout the [projects]" (10.Q6).

"[I like] an environment where I have high level interaction with an instructor and can do resource based learning using higher-level cognition, affective objectives, and performance in this hierarchy. My most satisfying learning experience is in tutorial situations and when involved in research" (6.Q6).

" [my favored learning environment] would be very rigid and task orientated, Clear cut instructions and a well defined objective are important as well" (1.Q6).

"The form would be much like PTE except that the Practicum would drive course work inquiry rather than the modules driving Practicum inquiry" (3.Q6).

"I have always been far more interested in the theoretical aspects of the content than the application of the theory to the environment" (6.Q6).

"Web-based instruction has been a very good form of instruction for my needs" (8.Q6).

"It would be web based. As an adult student, social interaction with other students becomes less important to me" (5.Q6).

"Web-based with multiple seminars" (2.Q6).

"I am most successful when learning by doing. The practicum and internship experiences were valuable. In my case, I want to learn as much as possible through experiences and not through reading, writing, or critical thinking. I'd rather build something and mess up along the way, then read about building something and try to apply the knowledge" (11.Q6).

"I do enjoy getting feedback from other students and bouncing ideas off of them so the discussion forum is important" (5.Q6).

" [I would like] an extended grading period. I don't like having to wrap up the modules in one term - I could learn more and do better if I could have an extended period of time to develop in each area" (2.Q6).

What is striking about all of the above requirements for a tailor-made learning environment is the variety, that also speaks to me of varying interests, aptitudes, learning styles, and personalities of even a small group of students. Call

it diversity if you will. But to me it also speaks to the fact that mass produced education cannot reach such diversity as well as web-based instruction that students can participate in on an individual basis. Embedded within the above statements are students who like to work alone, work together, learn by doing, have flexibility, have rigidity, have predictability, have spontaneity, etc.

Question #7-Affect on Beliefs About Learners

"Has your learning experience in this program affected your beliefs about learners and learning? In general? On the web?"

This question presumes that what we think about learners in general is also what we think about ourselves as learners. I was curious to find out if students could speak to their own personal schema through this question and in the process I would learn something about them as learners.

"My participation in this program has confirmed my belief that students learn differently. I see the web program as an option that may not suit every learning style, but can provide a valuable learning opportunity to many" (9.Q7).

" This program has only strengthened my commitment to web based learning as a wonderful delivery method for education" (12.Q7).

"I don't believe that my learning experience in the PTE program has greatly altered my basic beliefs about learners and learning, but it has certainly broadened my beliefs. My basic beliefs were not based on academics or training,

but on life's experiences. I actually felt comfort when learning that contemporary educational theories supported my personal theories" (7.Q7).

"I think the content has helped me learn more about learning than has participating in the workings of the web-based program" (4.Q7).

"It has given me confidence to learn in an inquiry based mode, and abandon the 'shovel it in' approach I grew up with" (12.Q7).

"If anything, I have come to appreciate how different we are in how we approach new information and ideas" (10.Q7).

"I am magnitudes more aware of different styles of learning than before and look for differences in my student population" (6.Q7).

"I guess the only answer I have is that I recognize that while I have good direction oriented learning strategies in place, there are other ways that I need to be aware of that will complete the learning process" (1.Q7).

"My perspectives on learners and learning] changed immensely. I came to this program at square one as far as learning theory goes. I knew that relationships and caring were important elements in the learning process, however, I had no idea there were cognitive learning styles and to the degree external environment forces influenced them" (3.Q7).

"I don't think my beliefs about learners and learning have changed" (8.Q7).

"I think interaction is an important part of web based learning. The

question is how the interaction should be constructed. Perhaps the answer is less modules/tasks and seminars once a month?" (11.Q7).

"I had the opportunity to explore many different philosophies. This has made me well-rounded as an educator. I am much more open-minded about learning and not expecting it to occur in a traditional setting only (5.Q7).

As far as learning on the web is concerned, I think it needs to be more dynamic. More interaction among students and instructors is needed" (11.Q7).

"I believe that the combination of web-based, interactive seminar, and asynchronous learning is the future" (2.Q7).

"I will say that I have become more sensitive to the different learning styles that people have. I used to think that we could all learn by reading or listening and so forth. Now I feel that some people are more successful using different modes of learning" (11.Q7).

In looking over the above students' suggestions for the perfect learning environment, and reflecting back on their answers to other questions, several patterns surface that are of interest.

- Awareness of Differences: Six of the twelve students spoke pointedly and in several cases emphatically about the changes in their perspectives on learning and learners by becoming more aware of differences in learning strategies, learning styles, ideas, other modes of delivery of instruction, and ways of communicating. It appears to me that this speaks well to issues of

diversity in all of its nuances, for it speaks to increasing awareness on the part of future teachers.

- Inquiry-based Instruction - Two students spoke specifically over the course of the questions about inquiry-based learning and how this was a different mode of instruction than they had been used to. They also spoke to the fact that it required different learning strategies from them.
- Generally, students in answering question #7, that asked how has this program effected your beliefs about learners, and web-based instruction focused their answers on the content of the modules, not on the web. In fact, several suggested that the instructional mode was not important. However, I would question this approach because I do not believe that our method of learning is entirely divorced from our learning, just as a researcher studying the effect of watching television on children is actually looking at a different aspect of a problem than the one they are looking at when studying the effect of what children are watching on television.
- Question #5 brought up the issue of communication, and interaction between students with each other, and with the instructor. I believe that the question of communication will require further examination beyond that this study undertakes.

Question #8-Affect on Student Developed Web Program

"How would you develop a web-based program for your own classroom? Would

you use any of the learning strategies you've developed from this course? Or, would you develop new ones? Why? How?"

The purpose of this question was once again to try to approach, from a different angle, students beliefs about learning strategies particularly in a web-based environment. I wanted to see if the PTE students, who are pre-service teachers, would discuss even obliquely what they believe about learning strategies used in a web-based environment. The strategy I used to try to determine this information was by using the idea of students developing their own web-based program. I believe that embedded in any program is not only the pedagogy of the primary designer, but the schema of that person relative to how learners learn and what facilitates that learning. Following are the students' responses to the above question.

Several student responses dealt with the students' feelings that a class or program that is offered on the web is not appropriate as the primary instructional tool for children, even if they are high school aged (that is the age most of our students are teaching). The primary reason one cites is the level of maturity they believe is required to effectively accomplish web-based instruction if it's the only source of instruction.

"I don't see a great need for using Web-based instruction at the secondary level for classes that I would create, but the use of the Web as a resource is certainly desirable. I believe that successful use of self directed Web-based

instruction like the PTE program requires a level of maturity in the students that is uncommon in adolescents" (7.Q8).

Other students talk about developing web-based classes and programs in conjunction with other things they are doing in their classes. What they appear to be describing is web-assisted instruction.

"If I were to develop a web-based program for my classroom, I would include a very similar structure. In working with younger students, I would assist the students by creating a notebook that includes the information that is provided on the OSU web page. In addition, I would add a vocabulary page for each module and speaking and presentation assessment opportunities" (9.Q8).

Or as one student describes web-based instruction, it could be an effective adjunct to regular instruction because of specific students needs, or community needs, such as completion of GED, etc. In this case, age or grade level doesn't necessarily seem to be a factor.

"I can see exceptions and possibilities for the future. One case is where schools do not have the resources for certain subjects. This could be occurring now, especially for rural schools. For example, if a student wants to take advanced field biology or advanced mathematics, but the school did not have the staff, a course could be administered locally, but taught on-line. Oregon High School (or whatever) could be established for students to take courses on-line that are not available to them locally" (7.Q8).

The same sentiment is expressed by another student, *"I see web based education as a good way for people to complete their high school educations if they no longer fit into the high school environment or as a way for military personnel to further their educations from remote areas of the world"* (10.Q8).

One student addresses the issue of hardware availability and capability, that was a problem even for the adult participants in the PTE program, as well as being an issue for other college students taking individual web-based classes.

"Here again you run into the problem that not all high school students have computers at home. That not withstanding, web based instruction would be a good way for students who have missed lectures or assignments to catch up or do extra credit. If there are other ways, I would not want to see web based instruction as the primary source of instruction" (10.Q8).

One student focuses on the social and interactive needs of children. However, she doesn't mention what role, if any, she would see computer-based, web-based, or web-assisted instruction playing in the classroom. I might interpret this comment to align with the beliefs of social constructivists about the social construction of knowledge.

"Personally I feel that children need the social interaction with their peers in order to understand how to get along with others. The school system provides more than academic learning" (5.Q8).

In all of the above cases the development of web-based instruction appears to be primarily for those educational situations that do not fit into the traditional

classroom schedule or environment rather than looking at web-based instruction as better in anyway. It's a practical approach doing what's more convenient. Then the issue of better or worse doesn't have to be dealt with.

One of the student expressed an interest in developing a web-based program but also expressed concern about the knowledge she believes she needs to acquire regarding how this would be done. Many teachers have expressed an antipathy to what they believe is *"learning how to program"* in order to develop web pages. I agree that this is a legitimate concern, and larger than most realize.

However, there are many products in various stages of development that could eliminate this requirement on the part of curriculum developers. The applications availability or as we used to call them programmer productivity aids that can write the code from English-language style instructions without the writer having knowledge of the syntax and commands of various programming languages is increasing just as it did in the 70's and 80's in order to allow users to program their own machines without a programmer. The important things that teacher's know is learning theory, student psychology, curriculum and course development. The technology piece is more structured and lock-step and applications software, that responds to the needs of the machine not the student should be readily available to teachers wanting to convert to web-based instruction. Otherwise, teachers become frustrated and disenchanted. And when this happens, it is extremely difficult to get them to return to this environment, even when teacher-friendly applications software becomes readily available.

"I don't know the answer to how I would develop a web-based program for my own classroom. This is one of the main things I hope to answer through my course of study. I would continue to use the learning strategies I have developed. New ones would naturally evolve, because the nature of a web-based program is itself evolutionary" (12.Q8).

Several students talk about experiences they've read about regarding university web-based instruction that could be applicable to high school on-line class development strategies and structure. *"I've heard of some university instructors who now have on-line office hours, conducted in a chat room environment. Most of the chat room conversation is potentially beneficial to all students, and is public. If a student wants to discuss a matter privately, the instructor temporarily goes to a private chat room. This could be an advantage for high school on-line classes where the teacher would be available at the same time(s) each day. Students would not be required to log on, but the teacher would be available to them on a scheduled real-time basis. Of course, email could also be used"* (7.Q8).

Another student goes into more detail devising again what I would call a learning strategy process made up of individual learning strategies. *"I would require students to complete one module on the web. Changes I would make are as follows:*

(1) alter the reading level to their level,

(2) include all necessary materials in the web site or in a packet,

(3) make the directions easy-to-follow for all reading levels,

(4) provide state scoring guides for writing,

(5) include a checklist with points for contacting the instructor to touch bases,

(6) allow a student to challenge a component,

(7) provide a glossary,

(8) not require students to read more than one or two other students' work,

(9) allow anonymity in responses.

I would not support a discussion forum (for a variety of reasons). I would keep a lot of the structure and approach that is used in PTE-NET" (4.Q8)

Another student returns to the overview level to discuss what he would embed in his web-based lessons, *"The lesson would use Resource based learning, curriculum based Internet projects, and the Writing Process. All three use cognitive, action, and behavioral tasks at different levels. I would use the learning strategies from these courses. However, the technical difficulty and level of student would determine the strategy:*

- *The need to develop a modified curriculum for specific learners.*
- *The need to provide the student with many levels for cognitive, affective, performance, behavioral and action tasks"*(6.Q8).

The following idea also speaks to the constructivist notion of socially constructed knowledge, and includes within it what Mezirow would call transformational application (Mezirow, 1994).

"I would set up a web page that the students themselves could run. The actual web site would be the content of the class. I actually am beginning to work on this type of project right now. I think directing the students to a defined set of parameters is important but with the nature of web-design, promoting self-defined learning strategies is important as well" (1.Q8).

"I think the PTE format is a great model to copy. Of course, my classroom not being at the graduate level would require some less rigorous tasks in the beginning that would build the students skill levels sufficient to function at the level of inquiry necessary for a PTE module type lesson" (3.Q8).

Some students discuss using a strategy for web-based program development that has historically been successful, , learning from someone else's work. Several of the students speak about the structure of the PTE program, *"if I developed Web-based courses, I probably would copy some elements of the PTE program, but I might include alternate communications methods"* (7.Q8). Or as another student stated it, *"I would develop a Web-based program for my own classroom in much the same way this program has been developed. I think it is an effective Web-delivered course. The School District also has an effective Web-based instructional program called SK-Online. Although I don't know the delivery methods and strategies of SK-Online, it has been praised for its effectiveness. I think I would explore that program and adopt some of the strategies that have proven especially effective"* (8.Q8).

One student has already begun to develop a web-site on his own: *"I am creating a supporting web site for my IT Academy. The site provides the textbook for the class. I use videos in class to provide students with multimedia instruction (and to provide a jumping off point for further discussion). I use Intranet web sites for students to post online portfolios that demonstrate their progress during the course. I want to provide students with a new model of how to learn in the 21st century (1.Q8).* Another student would, *"use a similar strategy as the PTE format that includes more sessions of face-to-face meetings*" (11.Q8).

Question #9-Strategies for Future Web Based Instruction

"If you continue to seek web-based instruction for yourself, which of your learning strategies would you change? Why? How?"

The purpose of this question was to increase student self-awareness when it comes to their learning strategy usage, and to reflect upon the appropriateness and effectiveness of them. Several students expression of their learning strategy usage for this program reflected the effort that they had expended to get the strategies they have, and that they are hesitant to change, *"I would not change any. It has taken me a year to become functional as it is"* (3.Q9). Another student states much the same sentiment, *"At this time, I have found a sequence of learning strategies that work for me. Although it took about nine weeks to develop this approach, it now seems to be working well"* (9.Q9).

As to how students would handle any new web-based classes that they might take, the following student said that they will *"Treat it as if it were a classroom. I'll be the first to admit that this kind of instruction has had its difficulties for me, but I do believe that I'm getting the upper hand on it"* (10.Q9).

Asked about any strategies they might change for future web-based classes, one student said: *"At this point, I can't say that strategies I might change. The strategies I have used have been effective for me so far. I'm sure I will continue to seek Web-based instruction as I have been satisfied with this program and it has met my needs"* (8.Q9).

Other students express, with reservation yet interest in continuing development, much the same strategy for strategy usage in a web-based environment. *"I would not change the strategies. However, their application would be contingent on the web-based Instruction program, lessons, and method of assessment"* (6.Q9). Another student expresses it as, *"I will not change any of my strategies at this time, but I am modifying and refining how the web, seminar, and e-mail information is used to create learning opportunities"* (2.Q9).

The strategies above, even those expressed with reservation, seem very appropriate to me as an instructor in a web-based environment, and as a ex-employee and manager in a similar workplace environment. Particularly in working with computers and its software, one needs to keep one foot firmly attached to the past before one steps completely out into the future, because the past is based upon computer applications that need to continue running and to return to a past

application without having a bridge is tantamount to electronic death. This is the major reason why everyone is exorted to back everything up. However, I like to think that persons who work with computers are optimists always looking into the future, making it better, faster, smarter, brighter, more useful, etc.

One hopeful perspective that came out of this questions was that none of the students said that they would never take a web-based class again. However, there seems to be a reality-based realization that this form of instruction is useful for educational institutions, useful for students, and is not likely to disappear. So, there's a certain pragmatism expressed in their thoughts as well.

Looking ahead, several students began to speculate on what they'd like to change, what they think must be changed, and maybe something new they'd like to try. These were expressed as follows:

"I would keep everything I have now, and stay receptive to fine tuning them. Probably the most changes will occur in how I handle the discussion forum. I also will probably add a strategy of reviewing the archives and capstones submitted by others. Right now I don't look at what others have submitted until I have completed the capstone, because I don't want to be influenced. The exception is if I'm completely stuck, that has happened only once so far" (12.Q9).

Another student's response to the question of what they might be likely to do in the future was, *"I fully expect to be taking more on-line classes. I'm not sure how to respond except to say that I would probably go into the classes expecting them to be about the same as my previous PTE classes. If they are not the same, I'll*

adjust as is necessary. If other students work is posted, I expect to perform to at least the same level" (7.Q9).

Several students began to look at their learning strategies again in terms of behavioral and cognitive and how those related to the tasks they were doing, and how those might change with future web-based experience: *"It is nice to have most of the action [strategies were] completed in the first term so that I can focus on the cognitive and behavioral needed to complete each capstone"* (9.Q9). Another expressed it as: *"I would focus more on cognitive learning strategies because that is where I feel I am weakest in terms of overall learning strategies"* (1.Q9). Another said, *"I would spend more time using a cognitive strategy. Now that I feel comfortable with web based instruction I could spend less time using the behavioral strategy and more time with cognitive. The behavioral strategy makes me feel more comfortable and confident with my learning, however, the behavioral strategy provides more results"* (11.Q9).

One student felt that content had an effect on their learning strategy usage. This was a re-wording of part of another question asked, to that the response has generally been that content and program structure had little if any affect on a student's learning strategy selection and usage. *"The content and instructions determine my learning strategy more than I do. I will do whatever I have to do, within reason"* (4.Q9).

The last student expressed a sentiment that is more pervasive than most teachers of teachers realize and that is that teacher's generally don't reflect on their

own learning strategies, *"When it comes to my own learning strategies, it's really not something I think much about. It's like breathing – I just do it"* (7.Q8). I must admit that like many teachers of adults I was content oriented (Cranton, 1994). I did not begin to reflect upon my own learning strategies until I entered the doctoral program in education at Oregon State University. I have always been intrigued by the way people learn, but had never thought of it in terms of learning strategies, and the ultimate cognitive processes that they relate to.

Visual Processing & Readability of Web Pages

Several follow-up questions were asked which related to the 'look' of the web pages (Appendix C). Since I found that so many students were printing them out in order to 'create a book', I presumed that possibly they were having trouble reading the pages on the screen. Their responses to these types of questions touched on issues of visual processing but also issues of hardware and software incompatabilities where the pages 'looked different' on their systems than they did on the ones at the University. Following are their responses to these questions and it appears to me that the issue of visual processing requires additional examination.

"I had no difficulty reading the pages. I had trouble accessing them at one point when the system was down. It was a very temporary, minor problem" (8.F1).

"Yes. I just printed everything before I started reading. I would then go back and research. I have to say that I did not even attempt to read the pages directly from the web. I printed the pages so that I could get

comfortable and read the information at my leisure" (9.F1).

"The Web pages for PTE were readable. The pages looked OK to me since all of the information was there. I could move between pages without any problem. When [program director] described what the pages looked like and the 'buttons'. I had the feeling that my own screen was different. When [program director] visited me at Scio he looked at the PTE Web pages. His statement, "they look very different on your system" but all of the sections were there" (6.F1).

"No, but my eyes get tired of looking at a computer screen" (4.F1).

Self-Description and Web-Based Performance

Students generally were very revealing in their critical self-assessments (Appendix D). The most revealing portions of these comments were their self-descriptions which gave me a real sense of how they saw themselves, and in examining their learning strategies, I could see that they tended to be consistent with the students self-description. Interestingly enough it appeared to be a connection between students self-description, whether they thought about the program meta-cognitively or tactically, how they selected and implemented their learning strategies, and their ultimate performance. This appears to be a subject for a greater in-depth examination at a later time. Following are some of the students self-descriptions from their self-assessments. Student comments are grouped by students so that their self-descriptions are more apparent when one considers they are were spread across several terms. The number following the 'A' for assessment

denotes the module number. There are 15 modules which students can take over six terms. Student #9 gave the following self-descriptions.

"I must have changed my outline four or five times. I decided to prepare a document that will be helpful to me (and possibly others) as I set up my classroom. This project made me realize just how much I am a "big picture" person" (9.A5).

"I found so many resources that pertained to my topic that it took a couple of weeks to reflect and synthesize my thoughts" (9.A6).

"While doing this module, I realized that I am very much a "big picture" person. I find myself wanting my own classroom so that I can implement ideas from the beginning of a class instead of trying break ideas into small parts to fit into a Capstone. I continue to struggle with knowing when to stop the research and write" (9.A7).

Student #4 gave the following self-descriptions:

"I had a very hard time sorting out the differences between scanning, focusing and other types of cognition. After rereading this section four or more times, I concluded that the text was not very clear. Therefore, I chose to omit that analysis from my paper.I also found it difficult to incorporate all of the theories listed on the syllabus into my analysis" (4.A1).

"Over all, this was not my favorite topic because it was extremely technical. I had a hard time retaining some of the seemingly small distinctions between different learning theories. However, I did give this module a tremendous amount of effort. I hope that is reflected in my capstone submission" (4.A1).

"Balancing "discussion" in the forum, research outside of required materials, and the written capstone posed a challenge for me in this module" (4.A4).

Student #12 gave the following self-description:

"I continued to struggle because there is so much information and so many different aspects of this issue" (12.A1).

"The power of online interactivity to release people from their physical, emotional, or socioeconomic constraints is mind-boggling" (12.A1).

"I feel my writing was a little "squishy" (Twomey, 10/23/99) in the middle, although I think it is a strong paper overall. This is a completely different kind of writing from the business and technical writing I've done for the last 20 years. When I write, regardless of the type of writing, I have a 3 step editing process. The first step is to get something in writing. This is referred to, perhaps unfortunately but descriptively, as the "Shitty First Draft" (Anne Lamott, Bird by Bird, 1995). The 2nd step is what I call "slash and burn," where I make the content organized, flowing, clear, and concise. The third step is the final draft. I love writing" (12.A5).

"Doing the capstone affirmed that I still love researching and poking around for information" (12.A5).

"I started with this module Winter term for 2 reasons: I wanted to clear my incomplete from last term and I needed to know how to plan lessons. I read the module information thoroughly, and reread it many times to be sure I understood

where I was going. I studied the task resources and made more notes than usual. I learned a lot of new vocabulary, and will need to review it, use correctly in a sentence, and apply it until I become fluent in the language of education" (12.A8).

"Doing this research had the added benefit of networking with the people I want to be when I grow up" (12.A9).

"I found so much information on school to work that I had to really pick and choose what would fit this capstone" (12.A10).

Student #10 gave the follow self-description:

"Here is a revised version of Capstone 3. I'm not entirely happy with it, but I can't seem to revise in way that totally satisfies me. Also, please take note that what was sent is not as I wrote it. Tabs and line returns have a way of disappearing. When I put them back in, I get 2 rather then 1. If I were to assign a grade to it, it would be Met Task Requirements. Truth is it's time to move on" (10.A1).

"On the no side, I took this a challenge and lost sight of the fact that the goal is to complete modules and finish the program. In short I did much more than was necessary to complete the requirements of the module. Given the chance to do it all over again, I'm not sure I would have done the same thing" (10.A8).

"As with all these Capstones I'm having difficulty with this kind of format" (10.A9).

"I'm aware of my own comfort zone, and maybe my comfort zone is based on my perception of myself" (10.A12).

I think it is apparent in reading the self-descriptions of the three students above that one is able to determine their learning strategies and draw some conclusions about their performance in the program. It seems apparent also that student #12 is taking a more meta-cognitive approach to learning than is either student #4 or #10. While student #4 is approaching a meta-cognitive strategy, what I call a 'stategy of strategies', it has not yet been achieved. Student #10 appears to be taking a more tactical approach to working with the web which translates to me that they are dealing primarily with each challenge as separate from the others and as a result are becoming more easily lost in the process. The relationship between meta-cognitive approaches to learning and tactical approaches seem to me to be an area which requires additional research.

The last section of my research study is called suppositions, conjectures, and reflections. Within the last section I will analyze some of the issues that students raised in answering questions about web-based instruction, and in discussing these questions, the literature identified above will be applied.

SUPPOSITIONS, CONJECTURES, AND REFLECTIONS

Human learning is a complex process. A process that is presently incapable of proof and even incapable of reliable supposition and conjecture. For that reason I have chosen to reflect as my final chapter on the above data and on my review of the literature as expressed in the learning strategies of a particular group of adult students in a web-based teacher licensure program. These suppositions conjectures and reflections are admittedly not applicable to a different type of group or even to a different group of the same type. However, if they can provide insight to other educators of adults who are also caught in the parenthesis (Naisbitt, 1982) of change from traditional classroom instruction to web-based instruction then they have value. If they can provide even a footnote to the body of knowledge yet to be discovered in this field, then they have value. I submit my suppositions, conjectures and reflections as my first step to some knowledge and experience of web-based instruction for adults, personal because of my own biases and limited by my data.

My suppositions, conjectures and reflections will center around certain issues that I believe were raised by examination of the PTE students' own words relative to their learning strategies and reflected upon in light of my research of the literature. Following are the suppositions that have been made:

- Expectation of what the program would be plays a larger role in success in the program than prior technical knowledge.

- Meta-cognitive issues play a larger role in selection of learning strategies than do purely practical considerations.
- Awareness of oneself in the process plays a greater role than awareness of the process within the overall program.
- High affiliation needs may impede usage of learning strategies that may be otherwise effective in a more affiliative environment.
- Descriptions of self and personality are consistent with types of learning strategies selected.
- Of the different levels of cognitive processing that appeared to affect the selection of learning strategies; meta-cognitive, process, and task; process appears to be the most effective in this type of learning environment and is controlled by meta-cognitive objectives.
- Once a process strategy was selected, the manner in that it was implemented was consistent with the individual student's self-description of the way they learn.
- Even though students express a strong need for affiliation and a preference for a learning community, all expressed feelings of dissatisfaction with the discussion forum, even though it was the only systematized way to communicate with each other.
- Most students expressed a preference for a face-to-face learning environment, although none were willing to trade the convenience of web-based instruction for it.

- Students discussion of desires for program and complaints about it often contained inconsistencies or conflicts of purpose that they didn't seem to be aware of.
- Students want to use the web without having to build web-pages or tinker with them to get them to work.

Following are several discussions of suppositions which I arrived at using student words and literature to give some depth to the reasons I arrived at the suppositions I did.

Expectations, Prior Technical Knowledge, and Strategies

In student responses to the first question of the questionnaire, when asked if learning on the Web was what they expected it to be, one said "yes", five said "yes with variations", two said "no", and four said, "do not know". This was surprising in view of the fact that all are getting licenses to teach business education or technology education, and all have at least 4000 hours of work experience in the field. In examining the data further, I discovered that none had ever taken a web-based class before except one who had some on-the-job technical training in operating systems. This was also surprising to me. But upon reflection, I realized that my surprise was misplaced. After all, these were people who had been educated in the same traditional system as myself. Even though we were working in technical fields or teaching students technical subjects, we were teaching them in

traditional formats using traditional instructional tools. Upon reflection, I arrived at the following suppositions.

- Expectation of what program would be like, plays a larger role than prior technical knowledge.
- Not having taken a web class before does not appear to affect strategies selected, only the time it takes to acclimate.
- Expectations without prior experience tended to be anthropomorphic rather than technological.
- Even after experience, all utilized a narrow range of traditional strategies with minimal transformation.
- Application of primarily traditional strategies appears to be self-limiting.

When the PTE students described their first learning strategies, I realized that these strategies needed to be examined in view of the fact that none had taken a web-class before. All had different expectations, and no doubt their first strategy would be a traditional one. At this point traditional strategies were all they knew. They had had no time or opportunity to modify any of their old strategies, or to develop new ones.

What I found was that all the students' initial strategies were based on traditional ones. The variances that existed were across the types of strategies, not between the students and their expectation when they started. In other words, they basically relied upon six traditional types of learning strategies, browsing the site, observing the direction that others were taking, printing web pages out and making

a book, reading tasks and syllabi, getting organized, and taking notes and highlighting them.

I believe that the conservative and traditional nature of their initial strategies was indicative of a natural fearfulness of a new environment, no matter what the extent of one's prior technical knowledge may be. In fact, I believe they actually expressed their uncertainty quite succinctly in their own words saying things like:"*hunkering down*" (12.Q2), "*staying with the herd*" (7.Q2), "*trying to figure out what I'd gotten myself into*" (3.Q2), "*not really knowing what to expect*" (5.Q1) and "*truly having no clue what web-based learning would be like or how I would go about it*" (10.Q1).

I saw this predicament from the student's perspective as a problem to be solved, what do I do, where do I go, how can I make it work, and how do I stay afloat until I figure this out? Since the students are also solving a technical problem relating to the best way to use the web and complete the instruction successfully, they definitely would appear to have benefited from prior technical knowledge.

A study was done by Wu, et al. (1996) that attempted to determine if there is a difference between technological problem-solving styles and personal problem solving styles with problem-solving style defined as a tendency to respond in a certain way while addressing problems, not as the steps employed in actually solving the problem.

Problem solving style was operationally defined in three dimensions: problem-solving confidence, approach/avoidance, and personal control (Wu, et

al.1996). Three groups of students were tested who were from varying disciplines: humanities, engineering, and technology. The results showed that differences occurred between personal problem solving styles and technological problem solving styles within the disciplines. Humanities students had the biggest difference, with their worst scores on technological problem solving, and their best on personal problem solving. Technology students had the best scores on technological problem solving and moderate scores on personal problem solving. No internal differences in problem solving styles were detected for engineering students between technological problem solving and personal problem solving.

In comparing the disciplines on all three dimensions, Humanities had the worst scores, Engineering had medium scores, and Technology had the highest. Problem solving self-confidence was best for humanities students but not for engineering or technology students even though in some cases the other two disciplines scored better. Consistent lack of difference across the three majors along personal problem solving suggested that students in all disciplines had similar personal problem solving styles. Significant differences on technological problem solving across all three academic majors suggested that students in different disciplines differed in technological problem solving styles. When the technological confidence score tended to be good, the approach/avoidance and personal control scores also tended to be good. The difference between personal and technological problem solving styles was significant for humanities and technology. They were the same for engineering students, suggesting to the authors

that there may be multiple forms of problem solving styles that may be related to the problems being solved.

Among the group of 12 PTE students, there were three engineers, two in technology fields, and seven from business. Among the twelve were also four getting second endorsements in Math: one engineer, one from technology, and two from business. In examining the students relative to research of Wu, et al. (1996) one could identify all the business education students with the humanities students and say that the concern they might have been expressing over what to expect in the web-based program might be due to the fact that their technological problem solving styles could account for their concern over lack of knowledge of web-based technology, but on the other hand one could say that their personal problem solving style may have made it easier for them to admit they had a problem.

Conversely, one could say that the problem solvers with technical knowledge, used their technology problem solving styles as they did because, as a result of that knowledge, they were aware of the issue of correctly solving a technological problem so they were cautious. However, if one were to consider that persons in the field of mathematics had problem solving styles similar to technology problem solving styles because their discipline is equally structured, then the ways in that a person who is also in one of all three of the other fields may have similar styles.

Basically I believe the problem solving style that students choose in any situation revolves around their own personal problem solving style, and the level of

their experience in the situation they find themselves, no matter what their technological knowledge may be. Several of the students, while not having web-based instruction experience, had considerable experience with technology and manifested the same hesitancy about how to proceed. The strategies students selected and how they used them were I believe a factor of how they viewed themselves which they gave clues to in their self-descriptions. After reflecting upon this issue, I arrived at the following suppostions:

- Student's strategy selection and usage was generally consistent with their definition of themselves and their personal problem solving styles.
- Once a process strategy was selected, the way it was used was generally consistent with the individual's self-description of the way they learn.
- Awareness of oneself in the process appeared to play a greter role than awareness of the process of the overall program.
- When asked if the delivery method of the program (Web based) and/or the program structure and content effected their choice of strategies, all students said, 'no'.

In working with the PTE students over the past two years, I have noticed that all of the students were hesitant and uncertain the first term. They reacted similarly as the current 12 students when faced with the new program. By the second term they knew what to expect, what was expected of them, and how to go about accomplishing the tasks. In fact, one of the students who planned to "*stay with the herd*" (7.Q2), abandoned that strategy in the second term. And another

student who said that he was using only "*low-level cognitive strategies*" (6.Q2) the first term, branched out to use higher-level cognitive strategies the second. What this suggests to me is that students with more experience in any environment, given additional knowledge and opportunity, will grow past their initial fearfulness. This fact may have the effect of reinforcing their personal problem solving styles because in the students' minds their growth represents the success of their self-perceived style, rather than any external factor.

Wu, et al. (1996) concluded their study by suggesting that teachers and curriculum developers should offer more emphasis on higher-order thinking skills and technological problem solving. While I agree with Wu's conclusion, I question their rationale for interpreting what they believe to be the significance in the difference between technological problem solving styles and personal problem solving styles. I suspect that what they saw, was what they were looking for, students with technological background manifest this background in their technological problem solving styles that are separate from their personal problem solving styles.

The Role of Situated Cognition in Learning Strategy Selection

Referring to the study on personal and technological problem solving styles could also relate to situated cognition, that is a more recent term used to describe the fact that learning strategies are often tied to the context in that they were learned (Duncker, 1945). The concept of situated cognition is interpreted in

different ways depending on the disciplinary perspective of the researcher and the use to that they put the definition. Three definitions follow:

Anita E. Woolfolk (1998): situated learning - "psychologists who emphasize the social construction of knowledge and situated learning affirm Vygotsky's notion that learning is inherently social and embedded in a particular cultural setting".

Dale Schunk (1996): situated cognition - "thinking is situated (located) in physical and social contexts, , cognitive processes including thinking and learning should be considered as involving relations between a person and a situation, rather than an activity that solely resides in a person's mind".

Pressley & McCormick (1995): situated cognition - "when students read, and write, and problem solve their understandings of these activities are largely tied to the school environment in that they acquired these strategies, making it difficult to transfer this knowledge to different environments".

Upon reflection I arrived at the following suppositions:

- Defnitions of 'situated cognition' tie learning strategies to context in which they were acquired.
- Positive aspects: learner can recognize 'similar' situatioons and select strategies which worked in the past.
- Negative aspects: can impede learner in transforming old strategies to new situations.

- Impedes learner from recognizing new situations which may need new strategies.

When the PTE students weren't sure that strategies to use, or that ones might be effective, they tended to go back to a prior time when a strategy they used was effective, in the hope that the same strategy would be successful in the present situation. They said things like, " *The PTE program is similar in pure web-based delivery, but was different in that..*", or "*Because I had worked some with XXNet, I thought it might be a computer based version of the...*".

It is interesting that the concept of situated cognition has changed in meaning since the time it was formulated. The concept began with Vygotsky and had a positive connotation (social and cultural). It then developed into a negative concept as limiting transfer of knowledge from one context to another. The concept has recently re-emerged concerning web-based instruction. It has also broadened to include cooperative learning (Klein, 1999) that is similar in intent to collaborative learning, and to distributed cognition that is a more automated version of the theory. This theory suggests that computers can perform some of the cognitive processing for humans, working interchangeably with them. There is also a transition from situated cognition to collaborative learning (Schneiderman, 1998) that incorporates important patterns of teaching and learning in the electronic classroom, (a) active individual learning, (b) small-group collaborative learning, (c) entire-class collaborative learning., and Interactive Learning (Reeves, 1997).

Reeve's version of situated cognition has a model with ten dimensions, that is proposed as an effective method of learning for the world wide web.

One has to ask at that point the theory ceases to be limiting and expands to be facilitative for learners in a web-based environment. Unfortunately, the terms and detailed descriptions of each of these theories have different elements and applications, yet they all relate themselves back to Lev Vygotsky's sociocultural theory (Vygotsky & Luria, 1930). Once again, I believe that Vygotsky is a theorist who makes a statement about the discontinuities in a line of reasoning sufficient, compelling, and logical enough to open a pathway for others to follow, and in the process, opens a new line of reasoning. Vygotsky helped create such a pathway from Behavioral Psychology to Cognitive Psychology.

The Role of Meta-Cognition in Selection of Learning Strategies

Most of the students stated that they had not thought about their learning strategies. As one student phrased it, "*when it comes to my own learning strategies, it's really not something I think much about. It's like breathing..I just do it*" (7.Q8). Also, it was somewhat difficult to get the students to talk about their learning strategies from a strategic or meta-cognitive point of view. They nevertheless implied their meta-thinking when they talked about their tactics, or procedures for completing their tasks. In examining their words, I have come to believe that most people are unaware of when they are being meta-cognitive and when they're not. In fact, I would suggest that for an educated person, there is a meta-cognitive overlay

to almost all of the tasks that we perform. Because ultimately, our individual tasks are part of a larger selection of related tasks meta-cognitively coordinated to achieve some goal.

Upon reflection on this topic area, I arrived at the following suppositions:

- Meta-cognition played a larger role in selection of learning strategies than did purely practical considerations; i.e. process or task.
- Students fell into two groups: those who approached the modules meta-cognitively and those who approached the modules as a series of discrete tasks.
- Students with meta-cognitive approaches tended to develop a 'strategy of strategies' which they ran as a process.
- Students with meta-cognitive approaches were more efficient and their performance was better.
- Students who approached modules as individual tasks tended to get 'lost' more easily, and had difficulty seeing how 'it all fits together'.

Flavell (1976) discusses the issue of meta-cognitive awareness describing meta-cognitive experience as any conscious cognitive experience that accompanies and pertains to an intellectual enterprise. The manner in that meta-cognitive experiences are processed impacts whether or how meta-cognition influences action. One example of use of a meta-cognitive influence is when one is struggling with a problem, and suddenly realizes the way in that a similar problem was solved.

Students tended to speak of their learning strategies to achieve goals from three different perspectives: the meta-cognitive level, the process level, and the task level. Students spoke regularly of the entire process of learning on the web using meta-cognitive metaphors, "*I have been successful at other programs and felt that this would be no different*" (10.Q1). This student started with a meta-cognitive awareness of a strategy to use for determining what the other strategies might be. Ausubel (1963) states that the ability to integrate and transform information is crucial to performance. This relates to the learner's ability to relate new information to prior knowledge. Even if students observe related information but are unable to evaluate its usefulness and relevance, even though limited, a failure to integrate and transform the information provides conflicts in terms of performance.

For students in the PTE program there were two levels of problem-solving that had to take place simultaneously determining the strategy for navigating the course web-site and its content, and studying, reflecting upon, and synthesizing information from outside sources, their practice teaching, and their past experience. Definitely the types of problems that the students were required to solve could be considered within ill-structured domains.

Value of Hypertext/Hypermedia in Forming Mental Representations

Tergan (1997) states that hypertext/hypermedia has the capability to present information in different formats, using different symbol systems and in the process, multimedia learning may be facilitated. Tergan continues to describe how this

technology allows for enlarging, selecting, or highlighting certain portions of image or text for emphasis, or reducing it for de-emphasis. In this way because of the flexibility of the media, the learner will be able to construct mental representations that are more readily adapted to different situations, enhancing different aspects of subject matter resulting in a better overall understanding, and enhancing cognitive flexibility and knowledge transfer. (Tergan, 1997)

Tergan described the ability to cope with complex subject domains and to build mental representations containing elements of knowledge, representational formats, and symbols systems as a natural part of human cognition. I am assuming here that in using the term "symbol systems" he is referring to language. However in testing this theory Tergan found that multiple representations may enhance learning when instructional scaffolding is provided. It may depress learning with novice students because of the additional cognitive load in making sense of each of the representations, and their interrelationship(s). Tergan tended to refer to this problem as an issue of "think time" (Tergan, 1997).

I would question Tergan on this conclusion because it seems to beg the issue of effectiveness of the strategy by saying that it is still effective, but couldn't be proven because students did not have enough 'think time' in order to incorporate the symbol systems into their schema. However, if a tool used to navigate the web is to be effective, it must be effective immediately. Use of the tool must occur before understanding of the tool rather than use of the tool occurring after

understanding of it. In the latter case the 'tool' becomes an impediment to learning rather than a facilitating device.

Certainly the concept of semiotic hyperlinks, or any other navigational facilitating process, is interesting if one considers applying it to a program such as PTE. Students in the program have stated that they had difficulty either processing the bulk of information or making the necessary connections. " *I found it difficult to write my capstone responses. It appeared that with each new day additional information regarding the module would present itself* (9.Q3), or "*I have even less of an idea of how I learn things now than when I started this program. It now seems to me that in order to learn something, I have to do more than just read material. I have to read it, underline it, and make notes on a separate sheet of paper"* (10.Q4).

Tergan (1997), believes that in order for the student to examine information of an ill-structured domain and then proceed to construction of mental representations that are relevant, they need to examine perspectives under varying conditions in order for knowledge transfer to take place. Use of multiple representations, such as those that hypermedia provides, actively engages the learner more fully in the process of their own knowledge construction. It allows them to ask questions, interpret material and compare different points of view. The assumption of Tergan's article is that hypertext/hypermedia, that is able to represent subject matter content from different points of view in different contexts and using different symbol systems functions almost like an electronic scaffolding

and facilitates learning.

I believe that Tergan's theory requires more research before such a claim can be made. Partially my reason for saying this is that I am coming to suspect that such devices do not facilitate learning, but they may surely impede it even for experienced students. And a major portion of this impediment is caused by cognitive overload that is a considerable issue in web-based instructional materials where colors, shapes, text, and flickering images require constant visual and cognitive processing on the part of the observing learner.

The Importance of Visual Processing in a Web-Based Environment

Web-based instruction is primarily a visual mode of instruction, even when students are reading text. Yet, the impact of visual anomalies on performance in this medium have not received much researcher attention, except for purposes of general access. Even for students with normal vision, there are issues of visual processing of computer generated images. Most people tend to accept visual processing problems as long as they are not extreme either because they don't know about them, don't want to talk about them, or because the human visual system is a master at accommodation. I suspect that all of these factors are operating at any given time on a learner who is experiencing visual processing problems unless the problems are so severe that some additional remedies are necessary for even the basic processing of the web-based pages and course content.

Reflection upon this subject resulted in the following suppositions:

- Student universally printed out pages from web site.
- Some printed all pages ahead of time, and others printed them as needed.
- Students who printed out all pages ahead of time tended to remain less engaged with the program in its web-based format relying instead upon their printed copies of the pages.
- All students expressed printing out pages as creating a 'book', a reason which they did not critically question; i.e. security? visual processing? overview? underlining?
- Visual problems were not directly addressed except by one student. Others referred to it anecdotally.

One of the students in the study told me privately that he had a fairly significant visual disability that he had struggled with over the course of his educational life, and that he felt was having a powerful affect on his ability to perform in the program. However when asked to record a description for the research project of the ways this visual anomalie expressed itself and affected his learning on the web, he didn't decline. He just never responded within the time of the study, even though asked several times. I have worked in the past with several other students with various visual anomalies and I believe that the issues these present to designers of web-based instructional materials are significant enough to require ongoing and specialized research, the results of that can be applied by web-page instructional designers.

Research that is presently being done in visual processing is mainly occurring in physiology and is focused on learning the physiological issues of visual processing (Montgomery, 1991). No wide-spread application of the findings has begun to occur although much interesting and relevant information is emerging. At the present time it appears that the technology of web-based instruction is overshadowing more finite concerns, such as web-page color and design. However this approach also occurred in the early days of computer applications software developed for non-system users. For that reason I have confidence that ultimately relevant research will find its way into application to web-based instructional materials.

Affiliation and Performance in Web-Based Instruction

One theme that most learners and teachers stress when moving from a traditional classroom environment to web-based instruction is the loss of face-to-face interaction with others. There is the generally universal belief that communication without face-to-face interaction is, somehow, not communication. Students when questioned will cite this as a major lack, effecting performance and loss of a sense of personality and community with other students. Even when reminded that for centuries letter writers on different continents, who never met each other face-to-face, built long-lasting and meaningful relationships with each other, students remain unconvinced.

- Most students expressed a need for the affiliation they found in traditional classrooms, yet rejected the discussion forum which was the only systematized way for them to communicate in the web based environment.
- All students, desirous of face-to-face were unwilling to trade convenience of web-based environment.
- When offered the opportunity for more face-to-face seminars, they rejected it because it meant coming to campus.
- Students were generally unaware of the disparity between what they said they wanted, and what they actually wanted.
- Low affiliation students may perform better and feel more content in a web based environment than high affiliation students.

Given what students believe about communication, it came as no surprise when students were asked to discuss their feelings about the discussion forum that is part of the PTE Program, all cited their feelings of loss about face-to-face interaction as one of the major factors affecting their feeling about the forum. One student expressed it as, "*Realistically, the forum is not as well moderated as a classroom discussion would be, so keeping up with the forum is difficult and not always as enjoyable as classroom discussion*" (4.Q1). Another acknowledged the realities of student/student interaction in web-based instruction as "*I knew that my face-to-face discussions with classmates would be limited*" (9.Q1). Another student, also acknowledging the realities of interaction in a web-based environment said, *"I might also add a regularly scheduled chat room because I think a live*

discussion would be more dynamic than the threaded discussion. I would not, however, get rid of the discussion forum" (12.Q4). One student expressed the feeling about the the lack of face-to-face discussion even more pointedly, "*I have found that I try to post my reflections to the discussion forum that directly related to the module I am working on. Other issues, I discuss using a face-to-face situation. I would keep the forum, but wouldn't expect much discussion. My preferred discussion occurs face-to-face so I find myself discussing issues at length with my mentor teacher and other education professionals. I have used e-mail sparingly and most often with the program supervisors*" (9.Q5).

Another student expressed a rather lengthy strategy that she used to cope with the discussion forum "*My learning strategy for participating in the discussion forum is still evolving. I have a hard time keeping up with it. Now I know that if I don't get any emails indicating action on the forum, I need to go in and check those settings. Usually I find that it thinks I'm someone else, and my subscriptions have been blown out. After accommodating for that, what I do is print out submissions that I want to respond to. I re-read them, jot a few notes, then go back online and post a response. I find I keep up best if I read, print, think about them, and take notes at night, then spend about 15-20 minutes the next morning posting responses. Something that doesn't work is letting too much time pass. You have to respond within 24 hours or we've moved on to something else. So not responding quickly was a strategy that did not work.....Regarding email, I try to respond promptly. I delete email notifications from the discussion forum that I have in my mailbox*

because I know they are also available on line. I have over 1300 emails (from everyone, not just the PTE program) in my personal mailbox so I'm not doing a very effective job in email area (12.Q5). Yet another student expresses their feelings about the discussion forum as "*Communication works best when it is real time between two or more people in a safe comfortable environment. I realize that web-based education is not just a fad, it is a new medium and is here to stay, but I think education looses something when you no longer have the comeradery of a group. I believe that the discussion forum is best used as a means of relaying experiences and events to others"* (10.Q5). And finally there is an openly hostile expression about the forum, "*I found the discussion forum to be a hassle. Often the conversation had nothing to do with the content of the module of the task that I was focusing on. Often the discussion forum seemed to be a conversation tool or a soap box for students. My learning strategy regarding the forum was to gain new ideas or resources from my peers. This worked sometimes but overall, I did not gain much from the discussion forum"* (11.Q5).

The issue of 'communication' and beliefs about the ways in which it occurs and its relationship to the building of a sense of community remain an enormous issue for teachers in a web-based environment because both teachers and students are fixated on the idea that for communication to occur, persons have to be in physical proximity of each other. The dictionary definition of communication describes it as 'conveying information' and says nothing about physical proximity between two people. I suspect that students are talking about two very different

things. For those who do not feel adept at expressing themselves in written form, the added social context of face-to-face allows for body language and facial expression to aid them in what they may believe is their less than excellent ability to communicate in only one form, written form. The second reason I suspect that students are talking about difficulties in web-based 'communication' is that they are actually referring to 'building a sense of community' and see 'communication' as the way that one builds that community. If we believe that communication is necessary for community and also believe that face-to-face is necessary for communication to occur, then it follows that we also may believe that without face-to-face, community cannot occur.

An interesting study by Klein (1999) makes observations about low and high affiliation students, their feelings about cooperative learning, and the affect upon performance. Although Klein's study was not conducted in and for a web-based environment, I think that it arrives at some conclusions that are applicable to this environment.

Klein questioned the concept of cooperative learning that is a basic constructivist theory for results of cooperative learning has led many educators to conclude that this form of learning is superior to traditional instruction for all students because it results in greater achievement by average students. However, Klein makes the observation that some learners are more predisposed than others to act cooperatively. The premise of Klein's research project was that

evidence of student's need for affiliation may affect outcomes in a cooperative learning setting.

The study used 122 subjects testing their feelings and impressions about participating in a cooperative learning exercise. The results showed the following:

1. Both high affiliation and low affiliation subjects who worked alone, performed significantly better on the knowledge portion of the post-test than those who worked cooperatively.

2. Both high affiliation and low affiliation subjects who worked alone expressed better attitudes than those who worked cooperatively, in thinking about future activities. (individual strategies may be more effective than cooperative strategies for enhancing motivation and learning during instructional lessons.)

3. Need for affiliation was related to attitude toward future learning activities, high affiliation students expressed positive attitudes toward future group work, and low affiliation students expressed a positive attitude toward future individual activities.

The author identified that the need for affiliation is related to student interaction behaviors, high affiliations participated in more on-task group behavior, and were more cooperative and social (Klein, 1999).

To re-state the results of Klein's study, basically, it was found that students who have a high need for affiliation performed better when working alone but liked it less, and had a more difficult time in applying what they had learned (Klein, 1999). It appears that Klein is comparing two things that are not necessarily

comparable feelings and behaviors. On the one hand the feelings of loneliness of high affiliation students affects their feelings of working alone on the web, but obviously does not impede their performance. The issue of difficulty of transference of knowledge may relate more to the contextualization of the knowledge when working in a group than it does to the socialization or affiliation for high affiliates.

However, it seems that for low affiliates, the values of contextualization may be offset by their feelings of preference for working alone. In Klein's study, both groups in thinking about future projects, were less favorably inclined toward group activities, but high affiliates were less inclined to want to work alone in the future, while low affiliates were more inclined to want to work alone in the future. It may seem obvious that high affiliates may have a certain sense of dread about a future group project but are willing to risk it for the sake of working with others. Since a web-based environment requires very self-directed (Candy 1991), and motivated people who can set their own schedules and discipline themselves to complete their work on time to their own personal best rather than a competitive one, an instructor has to wonder if students who plan to take web-based programs are better suited to these program if they are low affiliation types.

The Web: A Vehicle or a Tool for the Pre-Service Educator

In the early days of computer information processing, applications for non-technical users called for more user-friendly systems. Today, with web-users

flocking to the Internet and wanting to use web-pages for numerous activities, we are seeing a need for developer-friendly systems. One of the surprising things I learned from my data is that even adults who are professionally and technically experienced, and are seeking licensure to teach business and technology, do not want to build a web-site or tinker with a web-page. They merely want to use one.

However, upon further reflection I realized that the PTE students are teachers first and content specialists second (business education and technology education) and possibly web-users third. Web-development may not be a skill that they wish to add to their professional arsenal. Developing web-based instructional materials and programs can be a form of technological content specialty with educational intent, rather than an educational specialty with technological intent. Some educators take the step over and become the former, most stay on the educational side and are interested in using technology as a tool in their classrooms, but are not interested in becoming technology specialists.

Possibly this is where those of us who have begun to let technology take primacy out of interest and aptitude are being short-sighted in understanding exactly how big a step it is for an educator whose primary focus is education, to fight to stay on the non-technological side. One would like to think that with time, this polarization will diminish and all can work together in both types of classrooms, virtual and traditional.

Theoretical Perspective, An Inherent Disciplinary Bias

One of the reasons why I chose to do a multi-disciplinary perspective was primarily because my interests are multi-disciplinary. A second reason is because I find in reading similar theories in different disciplines, that disciplinary biases are inherent. These inherent biases don't appear to be immediately obvious to believers of the discipline's theory because most theorists and researchers are uni-disciplinary. I found discouragingly that in many cases researchers from different fields even when studying related topics do not read each other's work.

In those cases where there are multi-disciplinary researchers they are often marginalized or their pronouncements are met with scepticism at the very least and outright hostility at the worst. Presently it appears that theorists and pedagogists who are attempting to integrate technology into teaching exist on the periphery of education much the same way that post-positivists, feminists, and post-modernists did ten years ago, and that cognitive psychologists experienced twenty years ago when they chose to acknowledge that cognition and reflection played some role in behavior beyond unconditioned and conditioned stimuli.

Issues in Teaching Students Usage of Technology

One of the issues in teaching students to use computers, is the way in that they see or think about the computer that is the primary tool for this learning experience. The constructivist point of view is that student's knowledge is constructed both individually and socially. However, my conjecture is that the

construction of knowledge within the individual is individual, whether the source of the information comes from the senses from internal thoughts or from social constructs outside the individual (Von Glasersfeld, 1984). Taking this perspective means that social constructs are overlays that the individual must filter, analyze, accept, and integrate with their existing knowledge that may be done consciously or unconsciously. The underlying premise is also that nothing we experience is accepted just as we receive it and the process that occurs in the integration of it, that Vygotsky would no doubt call mediation is uniquely our own individual process both physiological and cognitive (Vygotsky, 1930).

Concluding Reflections

My concluding reflections are that web-based instruction is far more complex for the student than either teacher or web-designer has yet realized for a number of reasons. Students who have been successful in traditional educational systems have a powerful motivation to be successful in the new one, and generally don't tell instructors of their difficulties except anecdotally. Unless the teacher is sensitized to the degree of alienation, frustration and disorientation that the student feels, they will not hear what the student is saying.

Several overall suppositions are included in this last section for reflection by the reader and to establish a basis for declaration that the web based media used for instruction calls for more extensive and in-depth research at all levels. Some of the issues needing examination are embedded in my final suppositions:

- In web based instruction there are two types of learning taking place; interaction with the content and navigation of the web.
- Each type is a significant learning experience with its own series of strategies, which may be conflicting.
- Students tend to discount the latter experience, focusing on the former alone.
- This strategy tends to limit the learning strategies they select, and reduces the level of their overall performance.
- Even students with continuing experience, tend to continue using traditional strategies with minimal transformation.
- Students wishes for program features and complaints about it are ways it is not traditional instead of focusing on its potential as a new environment.
- Students were almost universally unaware of the inconsistencies in their expressions of desires and complaints.
- Most students wanted to use the web without having to build web pages or tinker with them to get them to work.
- Students generally approached web based instruction as a tool to be used rather than a vehicle for their own self expression.
- Web based instruction is far more complex than students, teachers, or web designers yet realize; cognitively, strategically, psychologically, and visually.

- Web based instructional development needs more 'developer friendly' tools in order for would-be teachers to want to create their own web classes.
- Web based instruction calls upon the other senses of vision and hearing more acutely, broadening access in one sense, while at the same time presenting additional challenges of accommodation.
- Web based instructional designers will be challenged to embed learning strategies in such a way that usage of the web site reinforces the strategy.
- Web based instructional designers need to design strategies which evolve as learners evolve.

Future challenge of web based instructional design will be to understand and integrate the needs of cognitive processes, visual processes, audial processes, and physical processes in ways facilitative for the learner.

Compounding the problem is the fact that technical designers of web-based programs and teachers in general have become so polarized in their attitude about web-based instruction that they not only can't hear each other, they can't understand each other. Part of this lack of understanding is that each has their own objectives and their own perspectives. For the technical web designers, the technology is the primary focus and education is secondary. This may be because technology is their primary task, and it is also their primary subject knowledge area. They are unfamiliar with the terms and theories of education or pedagogies, theoretical perspectives, and learning theories. When asked to create a web-class for an instructor they generally come at it objectively, which instructors do not.

For the educator the primary objective is education with the computer to be used as only one of many tools available for use in an instructional environment. Pedagogies, theoretical perspectives, and learning theories are tools of the teacher's trade. Web-site development is a different landscape with different pathways and road signs. A place an educator hardly wants to visit, much less spend any time in.

An issue requiring further study is the issue of accommodation in web-based design for our other senses that we use more fully in web-based instruction, vision and hearing. Awareness of the importance of these issues is just beginning to occur to designers of web-pages and research is in a very nacient stage. Having recently heard a representative from a major software developer tell attendees that they should design web-pages such that they are easy to produce, efficient to store, and quickly transferable without consideration for the issues of how they look. This exhortation made me more aware of just how far we need to progress in this specialized area of web-based instructional material design and development that accommodates all senses in human information processing, cognitive, visual, and audial.

Into this quagmire of cross purposes, the students who are submitting quietly to whatever they receive on the web in order to live at home, work from home, and get classes that conflict with their personal schedules, are bearing the brunt of the learning about web-based instruction for those of us who are designers and educators. More research needs to be done, and more educators and designers need to listen to more student voices. For students are talking, albeit quietly, and

we have to listen. The future of web-based instruction is sitting in his or her living room in Coos Bay, and Bend, and John Day, wanting to get their education through this new medium, and they are going to call on us, ready or not.

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APPENDICES

Appendix A

DEMOGRAPHICS OF PTE STUDENT PARTICIPANTS

Stu.No	Age	Gender	Endorsemnt	License	GPA	Entry Term	Trms
1	34	Male	Bus.Ed.	Trans	2.75	200001	6
2	43	Male	Tech.Ed.	Trans	3.09	200002	6
3	48	Male	Bus.Ed.	Reg.	2.60	200001	6c
4	29	Female	Bus.Ed.	Trans	3.98	199903	4c
5	38	Female	Bus.Ed.	Reg.	2.80	199902	5c
6	62	Male	Bus.Ed.	Sp.PTE	3.64	199901	9
7	41	Male	Tech.Ed.	Reg.	3.00	199901	4c
8	31	Female	Bus.Ed.	Reg.	3.42	200001	5
9	35	Female	Bus.Ed.	Reg.	3.60	200001	5c
10	43	Male	Bus.Ed.	Reg.	3.62	199903	**
11	27	Male	Bus.Ed.	Trans	3.60	199901	5c
12	44	Female	Bus.Ed.	Reg.	3.50	200001	6

** - Left Program

c - Completed or Completing Program by June 2000

12 students; 7 males and 5 females.

Overall average age - 38.91; Average age of males - 41041; Average age of females - 35.40. If older male student not counted, average age of males - 32.57.

Several reasons for older than average age of students in the PTE Program:

1. Students must have 4000 hours of work experience beyond beginner level in business or technology to be eligible for program.
2. Students must have a bachelor's degree.
3. Students must have experience working with students of age they wish to teach; not necessarily teaching, but must be in a public school setting and must be documented.

Appendix B

PTE RESEARCH PROJECT QUESTIONNAIRE

The PTE Research Project addresses the learning strategies which you have used and are using to work through the PTE Program. Learning strategies are considered part of the overall cognitive process because they aid students in achievement of learning. They can include, but are not limited to the following kinds of tasks:

- Cognitive - tasks which could be called "cognitive/thinking tasks" such thinking about, reflecting upon, mentally organizing, calling up earlier similar learning needs, etc., and deciding what to do. These include early cognitive processing for short-term memory, and deeper cognitive processing for long-term memory; i.e. the "think about it" tasks.
- Behavioral - tasks which could be called "behavioral" such as making of outlines, taking notes, copying pages, making graphs, charts, diagrams, or pictures of any sort, etc.; i.e. the "do something tasks".
- Action - tasks such as "doing something"; i.e. making your environment more favorable to your learning experience, structuring your work area, schedulling time to work, time of day, place, or people you discuss your work with, getting articles or books to examine, etc.; i.e. the "go make it ready" tasks.

Since learning on the web is computer-based and involves physical actions as well as cognitive ones, I have included those strategies which involved physical

action with those which are considered to be primarily organizational and/or reflective or thinking tasks calling them all cognitive.

My reason for doing this is because I believe that the will to action is first formulated in the mind in conjunction with thoughts and schema which do not have physical attributes. Once a conclusion is reached cognitively, the will to action is translated physiologically into action; moving, speaking, listening, and/or more cognitive action such as thinking, reflecting, and calling up of additional schema and beginning all over or continuing.

1. When you entered the PTE Program, what did you think learning on the Web was going to be like? How was it the same? Different?
2. What was the first learning strategy you used? Why did you choose that one? Was there any relationship between your learning strategy and the course content?
3. What were your subsequent learning strategies? Were they related to the first one? If so, how? Were they related to different course content?
4. How did the content of the modules and the structure of the web-site align with your learning strategies? What features would you change? Keep? Add?
5. Describe your beliefs about communication. Relate your beliefs to web-based instruction. Discuss the learning strategies you used for the discussion forum; task and capstone submission, and e-mail. Which ones worked and which ones did not?

6. If you could have the very best form of instruction tailor-made to your own learning style and strategies, what would it be?
7. Has your learning experience in this program affected your beliefs about learners & learning? in general? on the web?
8. How would you develop a web-based program for your own classroom? Would you use any of the learning strategies you've developed from this course? Or, would you develop new ones? Why? How?
9. If you continue to seek web-based instruction for yourself, which of your learning strategies would you change? Why? How?

Appendix C

FOLLOW-UP QUESTIONS

1. Did you have difficulty reading the pages from the Web? If so, how did that manifest itself?
2. What changes should we make to the web-pages to make them more readable?
3. What could we do on this end to make the whole experience easier for you?
4. Should we be teaching students any learning strategies for this type of instruction? Which ones?
5. How do you differentiate between a "cognitive" and a "behavioral" learning strategy?
6. Do you have a visual or learning anomalie which makes web-delivered instruction difficult?

Appendix D

PTE STUDENT SELF-ASSESSMENT FORM

NOTE: Actual forms are web pages written in HTML. The text has been re-created here for presentation in WORD format. Contents of these pages which were used related to the information which students provided in the section identified as "Comments" and as "Critical Review".

PTE Student

Module Capstone Self-Assessment Form

The following form is designed for you to self-assess your completed module capstone, which is presumed to show the results of your own work as well as discussion with your peers and colleagues in the discussion forum.

Your Name

Your E-Mail Address

Module Name

Use the PTE SCORING GUIDE to Determine Your Scores

Scoring Dimensions

Scoring:

E=exceeded standard

M=met standard

MWD=met standard with difficulty

NM=did not meet standard

Comments:

Theory into Practice

E M MWD NM

Reflection & Synthesis

E M MWD NM

Resources/References

E M MWD NM

Presentation Mechanics

E M MWD NM

Overall Rating

E M MWD NM

REQUIRED: In the text box below, critically review your work on this capstone project. Reflect on and describe the difficulties or struggles you had with this topic/subject. Describe what you learned from the processes of observing student behavior, researching, discussing the topic, and documenting your thoughts into this capstone project.

YOUR CRITICAL REVIEW OF YOUR CAPSTONE PROJECT GOES HERE:

PTE Student

MODULE SCORING GUIDE

Exceeds Standard (Professional Grade = A+)

Meets Standard (A)

Meets Standard With Difficulty (B)

Does Not Meet Standard (C)

Theory Into Practice

Exceeds standard and demonstrates creative and thorough application of theory to practice through responses to capstone and into participation in the Discussion Forum.

Meets standard and demonstrates theapplication of theory to practice through responses to capstone and participation in the Discussion Forum.

Shows insufficient application of theory to practice through products and responses to questions.

Shows lack of sufficient evidence of ability to apply advanced strategies.

Reflection & Synthesis

Exceeds standard and helps peers in the Discussion Forum to be self-reflective practitioners through sustained prompting and questioning.

Meets standard and shows shows evidence of growth as a reflective practitioner, including thoughtful commentary on resources and thoughtful participation in the the Discussion Forum.

Shows evidence of some growth as a reflective practitioner, including commentary on questions and participation in the the Discussion Forum.

Shows little evidence of reflection and critical thinking.

Resources & References

Exceeds standard and helps peers in the Discussion Forum to respond to tasks/questions/prompts in new ways.

Meets standard and actively engages with peers in dialogue; stimulating their thinking about postings in the Discussion Forum, but contributes few new ideas.

Engages with peers in dialogue about postings in the Discussion Forum, but contributes few new ideas or problem solutions.

Participation in the Discussion Forum lacks coherence and congruence with the content of the modules and/or with experience within the practicum.

Presentation Mechanics

Exceeds standard: definition of introduction, discussion, and conclusion; professional presentation of ideas; clear, concise, & flow logically; professional language; correct spelling and usage of grammar.

Meets standard using correct, professional language and presents ideas logically. No major spelling or grammatical errors, and citation of resources in correct form.

Ideas generally good but presentation of them is flawed; some spelling and grammatical errors; flow of discussion needs work.

Writing is not of graduate level calibre; use of cliche's and slang; spelling and grammatical errors; logical flow of ideas absent or interrupted.